THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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ELECTRICAL FATALITIES IN MINES.

IT is with regret that we have to chronicle more fatal electrical accidents in mines. The first of the extracts given below is taken from a letter over the signature of Mr. F. A Scott in the *Glasgow Evening Times* of May 25th last. This letter follows another dated May 10th, on the same question and by the same writer. In the later of these communications we read thus:—

> Since writing my last letter . . . I am very sorry to see *two* more deaths caused by three-phase alternating current in collieries. If things go on as they are doing I fear a very large number will be attributed to three-phase current by the end of the year, as in the past two years. . . . Why this "death-dealing current" is installed for mining work is known to a few only, and is a mystery to many. Where is the engineer who will say it is more efficient, less costly, or that it can do what direct-current cannot do, or will venture to say it is not more dangerous than direct-current? . . . So far as can be gathered in the Press regarding the electrocution at Uddingston Colliery last week, no necessary precautions could have prevented ironwork becoming charged with leakage current. It is not like steam or water leakage, it cannot be seen, but it is there in silence, like an iceberg in a bank of fog, ready to devour human life if proper contact is made.

In the same issue another letter appears over the signature "P. R. M.," as follows:—

> If anything further is necessary to convince the public of the wisdom of the remarks of Mr. F. A. Scott in the *Evening Times* about a fortnight ago concerning the dangers of alternating current in mines, it is to be found in the two sad accidents which took place last week, both deaths being due to alternating current. I do not think it is necessary in the face of the evidence we have been getting recently for me or anyone else to go into details as to the reason why it is more dangerous than direct current, as, since it has come so much into favour amongst mine managers, death from electric shock is becoming an every-day occurrence. This fact should convince all concerned that something should be done either to prohibit its use altogether or see that greater precaution is taken where it is used. Human life, not imaginary cheapness, should be the first consideration of all concerned in the production of coal.

Unfortunately we have no reports of the inquests on these accidents, and, consequently, cannot express any opinion as to the cause of them, but we have given the major portion of the above correspondence, as it is a fair sample of the opposition that we are afraid is growing against the use of electricity in mines in the minds of those who are evidently not fully conversant with its use. Both Mr. Scott and "P.R.M." seem to think that had direct current been in use instead of alternating current there would probably have been no accidents; this, of course, is against the accepted opinion of the electrical world. In fact, the Electrical Mines Inspector would go so far as to forbid the use of direct current in mines altogether. We are not now so much concerned with this point; it is more to the latter part of the above letters that we wish to draw attention, as it is through such views as these getting into the hands of the working miner that he is prejudiced against electricity.

Following this, however, we have a fatal accident on the surface at the Glamorgan Colliery, Rhondda Valley, and

an accident at the Newland Collieries, Normanton, to both of which we alluded briefly in our "Notes" last week. In the first case a "haulier" was driving a horse attached to two trams to the brickyard, when the animal came in contact with a live wire and fell dead, while the driver who held the "leading chain" fell unconscious on the horse. The yard foreman ran to the driver's assistance, and in leaning over one of the trams he received a shock and was killed on the spot. The driver, strange to say, ultimately recovered.

The second case is the old story of a man touching the "hauling rope" attached to an electrically-driven coal-cutter. It appears that the deceased—a man named Colburn—and three others, were working the machine. When the current was switched on, Colburn inadvertently put his foot, encased in a leather boot, on the hauling rope and immediately fell dead. The chargeman at once attempted to drag him away, but had to desist. This man also trod upon the rope, but as he was wearing clogs he only received a slight shock; in all probability it was this very fact that saved the man from injury, and perhaps from death. It was stated at the inquest that water had caused a leakage, and the current passed through the hauling rope; the manager of the colliery stated that such machines had been daily used for 23 years, but no accident had happened before.

In all these cases there is ample proof of very serious leakage, yet although each colliery installation is supposed to have leakage indicators, and a "competent" person under instructions to find and remove the leakage as soon as shown on the indicator, nothing is known of it until attention is drawn to it by a serious accident. It is, of course, natural to expect with the growth of the use of electrical machinery in mines that the number of accidents will increase, but it is no excuse to say that the number of electrical accidents is a very small proportion of the total number of fatal accidents in mines. There is one source of accident which will never be removed, viz., falls of roof and side; the danger of explosion may some day be removed as research and investigation into this question continue, but there *ought not to be* any fatal accident *due to electrical shock*, and if only reason and common sense were exercised in the installation and management of electricity, there would be none. There may be accidents—and always will be as long as machinery exists—through workmen becoming involved in the moving machinery, but the current should be so insulated and so controlled that the machine may be as safely handled as one driven by compressed air. No one ought to have the least excuse for saying, as Mr. F. A. Scott says, "*No necessary precautions* could have prevented ironwork becoming charged with leakage current," and we agree with "P.R.M." that "human life, not imaginary cheapness, should be the first consideration of all concerned in the production of coal;" but we are very much afraid that things will remain as they are, as long as the colliery manager is to take the responsibility and to be allowed to appoint a "competent" person. What, we may ask, is the Institution of Mining Electrical Engineers doing to remedy this state of things?

Naval Electrical Engineers.

General approval will be accorded to the new Regulations issued by the Admiralty, for the appointment of electrical engineers for service at the Admiralty and in the Royal Dockyards. Throughout the country, technical colleges are turning out the very type of young men fitted for this work, but hitherto it has been tacitly assumed that there is no opening for them in the premier Service. On the other hand, within the Navy the electrical staff has never seemed to us to be adequate to maintain and to handle efficiently the increasing number of electrical devices that are now essential in vessels of war. It was a serious blunder to hand over the electrical machinery, including the wireless telegraph apparatus, to the torpedo officers, instead of to the engineers, and it will take many years to straighten out the difficulties that this mistake has entailed. Moreover, it has been a serious blunder to envelop electrical engineering within the Service in mystery, and to regard it as secret, thus cutting it off from improvement from outside. It cannot be too emphatically stated and reiterated that every material advance has its origin in civilian sources and not in Service secrecy. A better means than at present exists should, therefore, be found for acquiring strength from without the Navy, so that the Navy may represent all that is best of the technical skill of the Empire. By judicious organisation this could be done without revealing anything that would inform prospective foes upon particulars essential to success in war. We welcome, therefore, the innovation as a step towards extending the use of outside knowledge for the betterment of the electrical arrangements in His Majesty's ships. These electrical engineers and assistant electrical engineers will, of course, be employed ashore, and they are not to be confused with the ranks and ratings on board ship, but, nevertheless, they will certainly instil new life into the electrical engineering of the Navy. We note that as a tentative measure an Admiralty scholarship in electrical engineering is to be instituted, and that it will be in force for a period not exceeding six years. It is to be awarded to a specially able and deserving electrical fitter apprentice who has completed four years' study in a dockyard school.

The M.E.A.

Early next week the fifteenth annual convention of the Municipal Electrical Association will be opened in Glasgow—a city which was honoured by a visit on the occasion of a similar convention held four years ago at Edinburgh, and in 1901-2, when Mr. Chamen was president.

From the engineer's point of view, Glasgow, with its highly successful municipal enterprises and its industrial position generally, is a particularly desirable city for head-quarters, and we have little doubt but that it will provide rather more than enough to occupy its visitors during their brief stay.

Municipal electricity supply has to a large extent settled into well defined lines, and it follows that the subjects which may be profitably discussed are somewhat limited; but while generation and distribution have reached a high degree of efficiency, the science of selling electricity appears still to be, if anything, rather neglected by the majority of supply undertakings, which, with certain meritorious exceptions, show little organisation or method in this all-important work. Electricity supply is so progressive in character that this end of the business might well benefit from a more frequent interchange of views.

Several interesting visits figure on the programme, for in addition to the well-known Glasgow stations, the Greenock plant with its "tub-feed" destructor (described elsewhere in this issue) should interest many engineers, and equally attractive will be the Clyde Valley Co.'s Yoker plant, Messrs. Beardmore's Dalmuir Shipyard, the works of Messrs. Babcock & Wilcox and Messrs. Bruce Peebles, and the gas engine and cement-making plant at the Coltness Iron Co.'s Works, which last was described in our issue of February 11th.

The presiding genius this year is Mr. W. W. Lackie, whose connection with the Glasgow Electricity Department is well known to the majority of our readers.

A Reminder of the German Collapse in 1900.

After referring to the recent upward movements in the prices of German electrical securities, a German newspaper states that the attitude of the electrical industry recalls to mind the times which preceded the serious crisis in the years 1900 and 1901. Then, as now, there were being brought into existence many central station and other undertakings, whose economic power of holding out and whose earning power were undemonstrated; they will probably require many years before they can yield satisfactory results, although

they provisionally bring considerable orders to the electrical companies. This, it is considered, should be a warning for the exercise of a certain caution. The situation of the electrical industry is in two respects substantially better now than at the period of the crisis. It has, in the first place, passed through a great process of concentration since that time, so that there are at present only a few large and powerful groups, which are extraordinarily sound from an economic standpoint, and which dominate the field; in this there is said to be a valuable guarantee for the distant future of the industry. On the other hand, a material difference exists between the promotion activity of the present time and that at the beginning of the century. Subsidiary companies were then formed in large numbers, and their shares or bonds were accepted for concessions, deliveries of machinery, works, &c., and, consequently, the monetary risks of the new undertakings were in the end borne by the parent companies. The Cologne Helios Co. and other companies collapsed on this system, whilst others which were much weakened had to seek support and shelter from stronger undertakings. To-day, however, the situation is different, for the financial risks are being unloaded on local authorities and unions of local authorities. Yet in this case also it is impossible entirely to escape participation, and if a reaction takes place in connection with the excess of zeal now developing in that special branch of the establishment of "overland" central stations, it is considered that the electrical industry will by no means remain untouched by it.

American Private Plant Costs.

Mr. W. O. Webber contributes to the *Engineering Magazine* for May some notes on the cost of running lifts, cash conveyors and electric lighting plants in American retail stores. The figures given are worth the attention of engineers engaged in similar work, although the writer shows a tendency to generalise overmuch from the instances cited. With his complaint that the users seldom know the cost of the power they use, every engineer canvasser will sympathise, but it must not be overlooked that such power costs are in most businesses but a small percentage of the total costs of the goods produced or sold; station engineers have reduced cost keeping to a fine art, so far as concerns the principal items of fuel, oil and water, but their expenditure on small repairs, lighting, cleaning and sundry minor works, which do not show up distinctly in the yearly returns, is often out of all proportion to the results obtained.

In comparing the performance of elevators which apparently are similar in all respects, the working speed and average load are not mentioned; the writer puts forward an average figure of 29½ cents per car-mile—say, 15 double journeys of 176 ft. for 15d.—and then gives the cost of two elevators as 29½ and 73 cents per car-mile respectively, the steam consumption per horse-power-hour being almost the same in each case. The difference between the figures is ascribed to a great difference in load factor in the two cases; this suggests that a more useful method of comparison could be found by ascertaining the stand-by cost per annum—or cost of keeping ready for use—and dividing the difference between such figure and the total cost by the number of journeys or mileage performed in the year. Describing the plant and machinery used in one store, the writer details a mixture of 10 steam engines, 5 pumps, 4 dynamos, 9 hydraulic elevators, 2 steam ditto, 1,200 16-c.p. lamps, 286 arc lamps, 2 steam-driven air compressors, and finally one 2-kw. electric motor—which suggests that there is plenty of opportunity to save money by spending it; a centralised turbine installation, or failing a suitable supply of cheap water, large gas or oil units with direct electric drive for lifts and machinery, and tungsten lamps for all lighting, would presumably make startling changes in the cost sheet and give the author material for another and even more interesting contribution to the Press.

Concentration v. Distribution.

As time goes on, change after change comes over the conditions governing electricity supply, and we have to modify our views and theories accordingly. But recently we doubled the voltage of the great majority of our supply systems, in order to effect an economy in the cost of cable networks, while retaining the advantage of concentration of generating plant; had the metallic-filament lamp been developed before the time when that step was taken, we doubt whether it would ever have been undertaken. Again, it is not many years since the supply of electricity to the whole of the metropolitan district from one or two huge generating stations was fervently advocated, and came near accomplishment, mainly on account of the development of the Parsons steam turbine. But the upshot has been—for purely political reasons—the establishment of the existing scattered stations on a more permanent basis than ever, with statutory powers to facilitate their interconnection for the purpose of mutual aid. It may prove, in the long run, that this, after all, was the best solution of the problem from a technical point of view.

In a leading article in its issue of May 19th, our contemporary, the *Electrical World*, discusses the question whether the concentration of the whole of the generating plant for the supply of a large area in one station is a wise or economical policy, in view of the altered conditions brought about by the steam turbine. Concentration of generating plant means at the same time increased cost of feeders and increased loss in the latter, together with greater liability to a disastrous breakdown. The great argument in its favour has hitherto been the resulting reduction of capital cost and of running cost; but it is pointed out that with modern turbine plant, three generating stations, say, each equipped with two or three large turbo-generators, &c., would probably cost little more than one station three times the size, and as the unit sets would be as large as those in the latter, and the several stations would be linked together, the running costs would be but little increased, while the reserve capacity of the plant of the same rated output would in effect be increased by the subdivision of the plant. The gain due to the shorter transmission, and the reduced number of sub-stations, might very well outweigh the comparatively small losses due to the subdivision, and the fact that the cost of plant has been so greatly reduced, and the efficiency increased, has materially lessened the ratio of the cost of generation (including standing charges on the generating plant) to the total cost, making the cost of distribution bulk more largely than formerly in the total.

Regarded from this standpoint, as we have said above, it may be that the London district will eventually be better supplied from a large number of stations, brought up to date and interconnected, than it would ever have been if the supply had been given from one or two large works, which would not even have been centrally situated. The points here raised have also an obvious bearing on the future policy of the large provincial power companies, some of which have already shown a tendency to subdivide rather than to concentrate.

Trade in May.

The trade returns for the month of May, issued this week, show considerable increases in both electrical imports and exports. The electrical goods imported amounted to £131,814, as compared with £85,469 in May, 1909, an increase of £46,345. The electrical goods exported were £206,549, against £162,784 in May last year, an increase of £43,765, making the total advance for the five months £785,535. General machinery imports at £430,770, were £25,982 down for the month, and machinery exports at £2,509,841, showed an increase of £94,529. Iron and steel manufactures exported at £3,629,965, were £489,778 better. The total returns show improvement in all departments, the imports being up by over ten millions, the exports by over four millions, and the re-exports by more than a million sterling. The imports increases are mainly in food supplies and raw materials, over two millions sterling being due to increased value of rubber imported.

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Debate on the Effects of Free Trade or Protection upon the Electrical Industry.

(*Continued from page* 932.)

THE consideration of this question was resumed on Monday at the adjourned meeting at Caxton Hall, under the ægis of the National Electrical Manufacturers' Association, who are to be congratulated on the success of this new departure. The chairman of the Association, Mr. H. W. Butler, again presided, and in closing the meeting, remarked that in view of the satisfactory results of the experiment, the Association had decided to repeat it next winter, the subject of the discussion being left for future decision; this is in accordance with the suggestion that we threw out in our leaderette of May 27th, and we are pleased to see that it has been so readily taken up by the Association.

The proceedings on Monday were much more lively than on the previous occasion; the speakers were earnest and aggressive, and the audience was for the most part keenly interested in their arguments. There was, it is true, a tendency, as at the first meeting, to wander from the question, and one or two speakers hardly touched upon it at all, but in dealing with a subject of such extreme complexity it is almost impossible to avoid the introduction of side issues. We were especially pleased to see our old friend Mr. Gustav Byng on the warpath again, and Mr. Robert Hammond, fresh from his political campaign, holding forth in his best platform manner. As was anticipated, the discussion was resumed by Mr. E. Garcke for Protection; Mr. Oppenheimer followed on the Free Trade side, and nonplussed his hearers with a request for information as to the weight of a truss of hay.

Mr. Gustav Byng dwelt upon the factors of cost of production, and was followed by Mr. Hammond, who, with the aid of a "bit of paper," demonstrated the balance of imports and exports.

Mr. Berry, looking extremely prosperous, introduced himself as a "terrible example" of the disastrous effects of Free Trade, and was pulled up by two previous speakers for describing them as non-manufacturers. Mr. Bond made some telling points for Free Trade. One of the best speeches was that of Mr. Bruce Anderson, an advocate of Protection.

At 9.45 Mr. Kingsbury rose to reply on behalf of the existing *régime*, dealing with several of the points raised during the evening, but directing his remarks mainly to Mr. Hirst's address; some 40 minutes later Mr. Hirst replied from the opposite point of view, and the discussion was closed by the chairman at 10.50.

Owing to the great length of the debate, we are obliged to postpone the completion of our verbatim report till next week; in the meantime, we think our readers will find ample food for thought in the moiety which follows.

THE CHAIRMAN: As we have a large number of gentlemen who are anxious to speak to-night, and as we are all anxious to hear the replies of the gentlemen who opened the debate, I must ask the speakers to be as brief as possible. I know it is difficult, but when I tell you that there are 13 gentlemen who have sent in their names as being anxious to speak, you will realise that if they each had their fair share of time we should be sitting here till past midnight. I will now call upon Mr. Garcke to commence, he having moved the adjournment last time.

MR. E. GARCKE: I have but a very few minutes, and, therefore, shall have to condense what I have to say into a very few words. I think that it would be fitting that I should commence by producing some authoritative and non-controversial statement on the present position of trade and commerce in this country, and I do not think I can produce a fairer quotation than that given in the Board of Trade return as far back as 1902 by Sir Alfred Bateman, Comptroller-General of the Commercial and Statistical Department. What he said in 1902—eight years ago—applies, I think, with still greater force at the present time. Sir Alfred Bateman stated: "We are still ahead of Germany and the United States in our power of manufacture for export, but beginning from a lower level the other countries are travelling upwards more rapidly than we are who occupy a higher eminence. If peace is maintained, both Germany and the United States are certain to increase their rate of upward movement. Their competition with us in neutral markets will probably, unless we ourselves are active, become increasingly serious. Every year will add to their acquired capital and skill, and they will have larger and larger additions to their populations to draw upon. It is necessary, therefore, more than ever, that the change of conditions should be recognised, and we can scarcely expect to maintain our past undoubted pre-eminence, at any rate, without strenuous effort and careful and energetic improvement in method. The problem how best this can be done is of vital interest to all classes of the industrial and commercial community." Sir Alfred Bateman cannot be accused of being a Tariff Reformer—as an official of the Board of Trade he spoke without bias, and if there was any bias at all, it was undoubtedly on the side of the maintenance of the existing fiscal conditions. Now what is the position at the present time? For some years past the average rate of unemployment in England has been approximately double that of Germany. All nations have suffered in National credit, but England has suffered in a larger ratio than other countries. With regard to emigration, which is another telling factor as to the condition of a country, emigration is greater from England than from other countries, and in Germany emigration is more than neutralised by their immigration. Those are the conditions that we have to deal with in this country at the present time. Various remedies are from time to time suggested, but we are confined in our discussion to consider the alternative of the fiscal systems of Tariff Reform and Free Trade. Unfortunately the fiscal problem has become a political question, and is being discussed not in the spirit of compromise but on party lines. Therefore, I think we are very much indebted to the National Electrical Manufacturers' Association for bringing us together with a view of the discussion of this very important question upon non-party lines. I want to put it to you that the views are not diametrically opposed; there is a basis for an arrangement, and I think I cannot do better than make a general statement on the point that I have raised between Free Trade and Tariff Reform. My argument is that Free Trade and Protection are interwoven in every country, and even every individual is both a Free Trader and a Protectionist. Each of us would like to have Free Trade in regard to commodities he buys and consumes, and would like to have Protection in regard to all commodities he produces and sells. This aspect of the situation is shown very clearly by the attitude of the English Labour Party. The Trade Unions of this country are the most protective institutions in the world. They not only regulate all competition among themselves; they dictate to all other interests in the country what should be paid for labour, and they even compel Parliament to grant them Protection of a kind which they would strenuously deny to any other section of the community; and notwithstanding their adherence to this highly developed form of Protection, they are strongly opposed to any kind of Protection for the products of their labour. It is most important that we should understand both sides of the question. I propose, therefore, to devote the few minutes I have to a general statement of the dividing lines between Free Trade and Protection, and to show the points of contact as exemplified by the excellent addresses of Mr. Kingsbury and Mr. Hirst. Let me deal briefly with some of the arguments in favour of Free Trade. It is because Free Trade has been so ably expounded by economists of the stamp of John Stuart Mill, Adam Smith and Cobden, that so many educated men are still Free Traders. Moreover, England for many years enjoyed phenomenal prosperity concurrently with the practice of Free Trade, but, as Mr. Hirst has shown, the prosperity has not been by reason of Free Trade, but rather in spite of it. The Free Trade argument is that the countries which adopt Protection injure themselves more than they injure us, and that a Free Trade country has the advantage of buying in the cheapest market; that dumping in this country is to our advantage, because we get goods cheaper than we can make them ourselves; that there is no great disadvantage in our not making the imported goods in the country, because we must make other goods for export or we could not pay for those we buy, and therefore, if we put an import duty upon goods coming into the country we should raise the price of those things against ourselves, and instead of buying from abroad we should make them less economically at home, and that by reason of buying less from abroad our exports would decline because if we bought less from abroad there would be less to pay for. In short, Free Traders say all imports must be balanced by exports, and by a Free Trade policy you get each country making the commodities for the production of which it is best adapted, and that if you interfere with the freedom of trade you substitute artificial for natural or competitive selection. But Mr. Cowan, who spoke last time, spoke as a Free Trader, and pointed out that while competition is a good thing you may have too much of it, and that all competition must be regulated. Will Mr. Kingsbury kindly say how we can regulate the competition of foreigners with our manufacturing without a tariff? Now let us examine the Free Trade argument. If you refer to the readings of Adam Smith, John Stuart Mill and others, and to the speeches of of Cobden, it will be found that what they meant by Free Trade was free exchange of commodities, and no one can doubt that free exchange of commodities between all nations is the ideal fiscal system, but unfortunately we have never had this ideal system of international trade, and the world does not appear to be yet ready for it, neither are we yet ready for the ideal method of settling international disputes. We still cling to expensive standing armies, not because we like them, but only because other nations maintain them. The doctrines of the Peace Society are accepted in principle

by everyone, but in practice we are unable to give effect to them. Cobden thought we should convince other nations within five years, but after 60 years other nations are further off conviction than ever. The statement that all exports are balanced by imports is nothing more than a general truism which is interesting to know and to bear in mind as an explanation of abstruse economical questions, but it has no more application to our particular domestic affairs than many other universal laws such as those of conservation of energy and of indestructibility of matter. The formula that all imports are paid for by exports means no more than the book-keepers' phrase that every debit must have a credit. No accountant, however, would be so foolish as to carry this formula to the extent of saying every loss is balanced by a profit. Exports balance imports—Yes! But we have to consider how and when the balance is struck. What if the things we import provide a profit to the foreigner, while the things we export leave us no profit? The result of the policy of Free Trade is that our profits are being gradually eliminated. If a large part of our exports consist of coal and other commodities on which very little skilled labour is expended, and our imports consist of manufactured articles, the production of which provides the means of subsistence for a large number of people, how can we say that we are greatly benefited by our large imports and exports. Mr. Kingsbury tells us that because we buy cheaply, we have efficiency, and as a result of efficiency we get a good balance-sheet. I do not admit that our ability to buy in the cheapest market has these results if we also have to sell in the cheapest market. We are doing a vast amount of work, and we have a large turnover, but there is scarcely any profit on it, and for this reason our imports from abroad depress the prices of our own productions, which, as Mr. Hirst has shown, cost us more to produce. Consequently, the margin of profits on our manufactures is reduced by greater cost of production and by reduction of price, and as we are competing amongst ourselves as well as with the foreigner there is a general all-round tendency to wipe out our profits. Now, the Free Traders say that this reduction of price is a benefit to consumers, and as we are all consumers we are all benefited; but this argument on behalf of the consumers overlooks the obvious facts that no country can subsist by consumption alone, and that consumers are finally dependent upon the profits made by producers. Furthermore, our policy of Free Trade is destroying that freedom of exchange for which Free Traders plead. They defeat their own objects because they encourage the creation of trusts and monoplies in foreign countries, one of whose objects it is to crush our manufacturers, and when foreigners have killed our industries consumers in this country will be at their mercy in regard to prices. Mr. Kingsbury, no doubt, will tell you that the foreigner will not be so foolish as to destroy a good customer, and that he will allow us to produce and export something or we would not be able to purchase from him, but remember that we possess enormous accumulated wealth, the result of past prosperity, and that we shall probably be large consumers for some time yet, even though we do not continue to make fresh wealth, but, meanwhile, we shall get feebler and poorer. Think of the figures. At the present time our exports of home produce to France, Belgium, Germany and the United States, our principal competitors, are less than half the value of our imports from those countries. What is quite as serious is that we are losing control of our Colonial trade, and that our foreign competitors are gaining it. At the recent Congress of Chambers of Commerce in Australia, the Commonwealth Minister for Trade and Commerce, said "that Australia found, with grave misgivings, that her trade with Great Britain was decreasing, and that she was becoming more and more dependent upon foreign countries. Had Great Britain retained the proportion of Australian trade which she possessed in 1880, she would have exported to Australia, in 1908, over £10,000,000 worth more goods than she actually sent." The Minister I refer to—Sir Robert Best—added that foreign competitors were already recognising that the Preference was affecting their competition in the Australian market. He drew special attention to the case of British cottons dyed and printed on the Continent, and then sent back to the United Kingdom to be shipped to Australia on the preferential terms. Do you realise what that means—it means that we are getting a preference from the Colonies, but by means of our open markets we give that preference to the foreigner—could anything be more absurd? We are told—never mind about these arguments—Free Trade is a religion; Free Trade is a faith; we have lived by it; our fathers have become prosperous by it; we have inherited their wealth; we cannot interfere with it. I say this, can you refer me to any social, any legislative law, I will go further, any ethical law, which has for all time remained unalterable? No. We are constantly altering laws; why not economic laws when we find that they are no longer adapted to the conditions under which we live? In conclusion, I would appeal to you not to discuss this question on political lines; because I feel that whenever politics are introduced into subjects, sincerity seems to be sacrificed. It is a pure accident that Liberals are Free Traders and Unionists are Tariff Reformers. If Mr. Chamberlain, as a result of independent thought, had arrived at the principle of Tariff Reform and Imperial Preference when he was a Liberal, the Liberals to-day would support Mr. Hirst, and the Unionists, in all probability, would be taking the side of Mr. Kingsbury. John Stuart Mill said that a man who only knows his own side knows little of that. Therefore, I appeal to you to understand and study both sides of this question, but I am not addressing that appeal to Tariff Reformers only; I appeal to Free Traders to make an effort for once in a while to understand the arguments on the other side.

Mr. Oppenheimer: Mr. Garcke has fully impressed me by his saying that Free Trade is a religion. I can give you some evidence asserting that Tariff Reform is a gospel, but neither he nor Mr. Hirst, in his endeavour to show that the electrical industry is suffering under Free Trade, has adduced a single argument which supports this opinion. I fully realise that it is an easy task to get up and talk like this where you are beforehand convinced that the majority are Free Traders. I shall have a less grateful task to convince you that Free Trade is not a religion, but nevertheless the argument will hold water. Will you allow me to refer to Mr. Hirst's speech, and to pick out from his able deductions a certain point he addressed to you in the form of a question. He asked you why it is that since 1881 we have lost the supremacy we then undoubtedly held, and notwithstanding the cold he was suffering from, he skipped carelessly over the period which lay between 1846 and 1881, without even hinting at the possibility that he could furnish himself the reasons why after 1881 there set in a certain set-back. I shall endeavour, with your permission and providing that a few arguments are allowed me, to show that Mr. Hirst would have been right if he had told you that that very period saw some events come to pass on the Continent, and especially in Germany, and I lay stress on this very particular point, because during the whole conversation and discussion I have not once heard an argument selected as emanating from or relating to France. It is invariably Germany which supplies the prominent *rôle*. I am going to show you that in 1868 there came something to pass—not the abolition of Free Trade, but the adoption of Free Trade in Germany. There came to pass the abolition of Protection in Germany, and this is the starting point from which you can trace the rise of industrial Germany. In 1868 the Zollverein was created; up to that date 27 different States in Germany had 27 different Customs tariffs. One could not walk 2 miles without being confronted three or four times by different Customs officers asking for a toll. Now, gentlemen, this state of affairs existed up to 1868, but the very day that the Zollverein was abolished people abolished their Protection, and Free Trade was their banner. It was obvious at that time that Germany industrially was no power whatever. In fact, it was in the first years of its childhood. The very moment this Zollverein had been abolished people felt their legs, and if one would follow the arguments of Mr. Hirst one would ask oneself, "Why should not a second miracle come to pass like that which happened in Biblical times when the sun stood still in order that Joshua might win his battles?" Exactly on the same line Mr. Hirst argues, and says, "Why have we lost our supremacy? Why are we not foremost in every undertaking either at home or abroad?" Up to that time we had no competitors. Quite true; I do not deny it for a moment. But I maintain that other people who were nonentities at that time began to find that they could do something, and that the only country which hitherto could do something was England; but it should not do it in the future, because after all, progress cannot be protected either by Tariff Reform or by any other means. But I will now produce arguments to prove to you why progress has taken place so rapidly in other countries; and why it must be so. In 1872 Germany adopted the metric system. That was further towards the accomplishment of what their statesmen had in view, and I ask you to-night, gentlemen, whether you are able to tell me whether such a simplification of weights and measures has not been an enormous lever in attaining that result of making progress? I ask you to-night how many of you gentlemen are able to tell me what system of weights and measures is in existence in this country. You look aghast at my question—I am not surprised, but I still maintain that if I were to examine you now to tell me how many different systems of measurement and weight are in existence, not 5 per cent. of you would be able to pass the examination. It is a bold statement, I am fully aware of that, but I will give you a single example. Assuming you are asked to construct an electric crane which would lift a certain load for an agricultural undertaking and the information at your disposal reads somewhat as follows: "We require an electric crane capable of lifting 36 trusses of hay." Now, gentlemen, can any of you tell me how much weight is in a truss of hay? I am still waiting for the answer. I think I have proved my case, but I can show you that if someone by accident would know what a truss of hay is I assure you he would be wrong. I have before me an extract of those well-known tables by Mr. Weightman which are generally provided on the back of the exercise books of our school-children, and amongst these useful notes I found the following description: "Hay and Straw Weight.—A truss of straw weighs 36 lb.; a truss of old hay, 56 lb.; and a truss of new hay, 60 lb." Now, gentlemen, we are all given to making hay while the sun shines, but I can assure you that, with this variety of weights and measures, there is no wonder why we do not make hay while the sun shines. To come back to another point which, to my mind, is a very important one, and one which has not been even touched upon in the long discussion we have already had. It is that the biggest blunder, politically and economically, ever committed by this country took place in the passing of the Merchandise Marks Act. And that gives me the solution why Mr. Hirst could not find an answer to his question, "Why have we lost our ground?" Now I ask you to imagine for a moment that, up to 1887, which was in the heyday of our success, we were the general distributors of our own manufactures and the manufactures of foreign countries. In 1887 an attempt at Protection—so-called Protection—had been made in order to guard against the possibility that foreign-made goods should be mistaken for English goods. What was the result of this attempt? We gave some most extensive, and, alas, some most expensive, free advertisements to the Continent. If you come to scrutinise these three points I have taken the liberty of putting before you, and adding to them the further matter of the nationalisation of railways which took place in 1892, then you have in a nutshell the whole answer to that very question why

we have not made progress. I am not going to bore you with statistical figures or with the argument that Free Trade is the panacea for all ills. Nothing of the kind. Nor am I going to say that Tariff Reform is indeed Pandora's box. I agree with Mr. Garcke that both sides have advantages, and very likely both sides have some disadvantages. We have come here to-night for the purpose of discussing the abstract question "Is Free Trade or Protection our salvation?" What we have come together for is to find a common basis from which we can work out our own salvation. I maintain that the electrical industry itself is not what it should be. I give you that frank admission forthwith, and without any hesitation, but I say it is certainly so in spite of Free Trade, and it would be ill, hopelessly ill beyond recovery, if Tariff Reform ever attempted to come to its rescue.

MR. G. BYNG: The most important statement of Mr. Kingsbury's able address, to my mind, was the one in which he referred to the cost of production, and in which he said that Free Trade gives us advantages for cheap production. Now *does* Free Trade give us advantages for cheap production, or on the contrary, is Free Trade the cause of inefficiency and dear production? That to my mind is the crux—the Alpha and the Omega of the whole controversy on the fiscal reform question. I know there are hundreds of other questions connected with this controversy such as Mr. Oppenheimer just now referred to, like the metric system and other important matters, but I say that none of them are of any importance compared with the question of the cost of production. If any Free Trader—if Mr. Kingsbury, for instance, or the Editors of the ELECTRICAL REVIEW—could prove to me or prove in any way that Free Trade gives us the slightest advantage from cheap production, I, myself, would turn a Free Trader. Mr. Kingsbury says that under Protection the cost of production will increase. I join issue with him, and I challenge him to bring forward one single proof. The Free Trader argues in this way—the first factor of production is material, and they say that Free Trade gives you cheap material. I am acquainted with a good many industries, and I have never found that this is true. Take, for instance, our own industry—the electrical industry. Do I get my copper, or my iron, my platinum, my glass, my china, rubber, cotton or any other material which I may use in my manufacture in any way, or in any degree, cheaper than my competitors in New York, or Berlin, or Paris? My experience is that I do not get it any cheaper. The next factor for cheap production, the Free Trader says, is labour; Free Trade gives you cheap food, and, therefore, cheap labour. It is well to be clear upon this point, to well understand the attitude of the Free Trader on the question of wages. When he talks about cheap production, he says, "I will give you cheap labour; cheap wages," but when he is on a political platform, speaking to the workmen, he says, "Here, under Free Trade, your wages are much higher than in Protected countries." He cannot have it both ways. I should like Mr. Kingsbury to tell us which way he will have it. In his speech I have noted several passages which point both ways. Now, it does not matter very much what the Free Trader says. The real truth is that under Free Trade, wages must go down, down, down. It is impossible for our workmen to allow the whole world to compete with them, to allow nations where wages are very low to compete with them, without, in the long run, having to level themselves down to those nations. I venture to prophesy that if we continue in this foolish way in our fiscal policy—this foolish Free Trade policy—then it is our poorer classes who will have to pay the piper. It is they who will gradually have to continuously work for less wages until they come to the lowest. I hope it will never come to that. From that point of view, no doubt, the Free Trader has some justification in regard to cheap production. Still, you will agree with me that cheap wages do not necessarily mean cheap goods. Nowadays, when machinery is used for every sort of production, the experienced manufacturer knows he gets the best output and the best results and the best returns from his machinery if he uses the best paid labour. But as you know, it is not only labour and material which make up the cost of production. As Mr. Hirst, in his able address to you, has clearly pointed out, there are other and equally potent factors which go towards cheapness of production, notably skill, invention, and, above all, the quantity which we manufacture. These are factors which are important in making up the cost of production. In all these factors the protected manufacturer has advantages immensely above us. These considerations, which I may call theoretical, are borne out by facts—facts which we experience daily in our commercial pursuits. I do not care what you take. I do not care whether it is an article of manufacture or a product of agriculture; I do not care whether it is a dynamo or locomotive or a button or a pair of spectacles, or a pound of cheese or a pound of butter. Take anything you like or almost anything, and if you go into the matter and compare the manufacture of such an article in this country at the present time and the same manufacture abroad under Protection, you will find almost invariably—there may be a few exceptions—that it is manufactured on a larger scale in Protected countries, and therefore at a lower cost. Free Traders have sat in their studies and have burned the midnight oil, and have never touched a piece of machinery, and they have written of these things. They are men like Adam Smith, a Scotch professor, or Ricardo, a foreign banker, and John Stuart Mill and Prof. Farrer and Prof. Fawcett. These are the men who have written the books which are now considered infallible. They had an inkling at the time when they wrote all these carefully thought-out ridiculous systems that, after all, unlimited competition might do some harm to some industries. They had an inkling that they might do some harm, so what did they do to ease their conscience? They, of course, sat down and made another law, and that law said that a man who could not compete in making one article would make something else for which he was better fitted. Mr. Kingsbury evidently has a similar inkling, and I find in his address that he also says practically the same thing. He says:—"As if it were not established that an industry ruined in a Free Trade country has another industry growing out of its ruins." That is a law as false as it is stupid; it is a wicked law. It contemplates ruin with the greatest complacency. It says:—"On my conscience, it is a very bad thing to do something to ruin an industry, but out of that industry will come a Phœnix." No new industry can be established under Free Trade; no industry can grow under Free Trade, neither out of ashes nor out of words. I say that if a Free Trade industry is attacked, that industry must go to the wall under Free Trade. We are in a Free Trade country here, and it is the foreign manufacturer who has got to say, it is the Protectionist manufacturer who has got to say whether the English manufacturer has to exist or not; whether his industry is to be attacked or left alone; whether it is to be harassed, or ruined. Time does not permit me to dwell more upon this subject, but I hope that my hearers to-night, when they are thinking over this question of fiscal matters, will mainly direct their attention to the question of the cost of production. If they do, I believe that they will agree with me, and that they will come to the same conclusion that I have come to, and that is, that it is due practically, and almost solely, to our stupid system of Free Trade that we are declining in the nation's capacity of production. I say that this might not be so very terrible; in fact, a Free Trader said to me this very night:—"It is very nice, let them produce cheaply, and we can buy cheaply." This is very terrible to the man or trader who cannot buy or manufacture as cheaply as his neighbour, for it means that he must go to the wall, and that the nation that cannot produce as cheaply as competing nations around must decay—it must be ruined. The hand-writing on the wall is as plain as plain can be, and I say it is a pity that there are men round us who cannot see it or read it. I say that Free Trade means dearer production, and dearer production means decay and ruin. That is the doom that is in store for us if the will of those men prevails. I cannot see that anything can prevent it. That is the last stage of the policy of Free Trade.

MR. ROBERT HAMMOND: I feel very much indebted to the organisers of this meeting. I think it is a splendid thing that we who are "pals," shall I say—friends in the same industry, all having the same object, of increasing our income—should meet together and, without any hesitation, express our views upon this question. Well, I find it is acknowledged, in the first place, that we cannot protect our industry without protecting some others. When I was first told about this meeting, I thought that it was some sort of a discussion as to whether we could not get Protection for the electrical industry and the electrical industry alone; but I am glad to see that we have all come to the conclusion that we cannot so limit it, and that practically what we are met here for is to discuss the great national question whether Protection or Free Trade is best for England—not for Germany or for Italy, not for Timbuctoo or the South of Spain, but for England. I dwell upon that point because I say that England stands in a position which is unique. We have 44 millions of people in an area that will only grow food for half of that number; which half has got to starve?—Not this half, if we can help it. Now the question whether the other half of the world is going to starve turns upon the point that Mr. Byng said was ruining the country: the question whether our manufacturers can fight the world. What is the position? I take up Mr. Byng's point. We are limited in time, and we must talk of one thing at a time. Mr. Byng said that if we could convince him that Free Trade was the best thing for the manufacturer owing to the fact that it gave cheaper production, he would come over and sit by me here instead of sitting over there. Why, it was proved last year. I am not going to talk about those old gentlemen that Mr. Garcke seems so well acquainted with of 40, 50, or 60 years ago. To me England is the living England of to-day, and against that, for the whole of the talk of the past, and what the old gentlemen said would occur and would not occur, I care nought. I ask what is occurring to-day? What is the writing on the wall? You have written on the wall as the outcome of the trade of England, larger figures than we have ever had before. That is a living thing to talk about, and it is not talking about theories. What is the fact? Two hundred and forty million pounds' worth of food came into this country last year. There are some people who think that instead of encumbering the ground with Osram works we should grow corn everywhere. If we did that, what would become of our manufacturing supremacy? Mr. Hirst said, in his opening, that Free Traders were people who maintained that we should be better off if we were not manufacturers of Osram lamps or otherwise in England. I have been a Free Trader for 40 years, and I say Mr. Hirst's portrait of me is not a correct one. The gentleman who said that what we wanted was help for our decaying industries was on the morass of falsehood. We do not want the decaying industries protected. The boot trade was a decaying industry in England. Under the system of Tariff Reform that would have been protected, but what did the people in the trade do?—They faced the position and they got in American machinery, and turned their works inside out, until at the present time instead of receiving boots from America they are sending them over there. I take that point, and I say it was proved last year. £242,000,000 came here in food. A Tariff Reformer says "shame." It is the glory of a country when its people require food to be able to throw its doors open to all the world—every part of the world where food can properly be grown; that is, in the country for growing corn on a large scale. Pineapples are not the best thing to grow in England, and corn is not the best thing to grow in England; certain soils will grow corn, and those who have been across the great plains of America know where it is to be found, but I want to get this point home—our policy of opening our ports

to the world has brought us in exchange for our products food stuffs amounting to 242 millions sterling. Now that has got to be paid for. At the beginning of this controversy it was said that we poured out our golden sovereigns from England. I was very pleased to hear in Mr. Garcke's speech that that fallacy had been knocked on the head. No, we don't pay in gold. Last year we received into this country six and a half millions more gold than we sent out. Some people think we pay in securities. Others talk of wealth decreasing; but that is all wrong. The income-tax returns show most clearly that we are getting wealthier and wealthier every year. Well, we don't pay in securities; and the only way in which we can pay is in our manufactures. Mr. Garcke says we send our coal out. What did we send out last year?—37 millions' worth of coal out of 378 millions of our exports—37 millions, and the bulk of it for the use of our own ships and our own mercantile marine, and our warships all over the world. Little at the end did the foreigner get of that coal in comparison with the bulk; £242,000,000 had to be found for the food of the workers; the manufacturers had their factories, they had their coal, they had the steam to work with, but they had not got the raw material. Very well, it has got to be paid for—166 millions of raw material; total indebtedness, 408 millions. How was it paid for?—Not in gold; not in goods. We did not go and say, "If you will give us corn we will give you goods; what we want is payment for our coal." How was it paid for? Do try and let us get this point home, and it will answer Mr. Byng. It was all paid for by bits of paper. That is all. Paid for by bits of paper. The whole lot paid for. Here is one of these bits of paper. It is a bill of exchange for £2,712 10s. It is drawn by Wilkins, Wilkins & Co., of Montreal, to Messrs. Dipnall & Co., of Mark Lane, London, and it represents a shipment of corn valued at £2,712 10s. shipped by the steamship *Atlantic*. What is the good of that bit of paper? It is gold in England and means wealth. Canada wanted agricultural machinery, and it is buying largely from America, and the bill is endorsed to Messrs. J. S. Morgan & Co., of New York, for value received. Now America seems to have been buying silks from Japan, and the bill is endorsed by Rogers, Sugita & Co., of Yokohama. I know that firm. It is an English bit of paper, but it has now got to Japan. Now Japan buys new cotton from India, and so the bill is next endorsed by Dam, Sutjee, Bannerjee & Co., of Bombay, and in India this bit of paper rests for a day or two, and then it is sent to the Manchester Spinners' Association, in Manchester. What has it done? It is the payment for calicos; so the practical thing is that the corn which came from Canada was paid for by England by clothing the women of Hindustan. Mark you—and this is my illustration to Mr. Byng—all the world wanted that bit of paper. There was no reason why it should "home" in England except only to be paid for. All the world would compete with our manufacturers, but we beat them hands down, because in quality and price we were right. There is no reason why the exports should be paid for by imports. This piece of paper might have gone to Germany, if Germany could have beaten us in the foreign markets. The reason that bit of paper came back to Manchester was that England was right in quality and in price. That this Free Trade England to the extent of its exports competes with the world proves to Mr. Byng that with the world as a competitor it could beat the world in price and quality. I say that which occurred to this piece of paper occurs to hundreds and thousands of other pieces. I have not time to show to what extent the imports have balanced exports, but I will say that those who want to decrease the imports will not increase work as Mr. Hirst said. They will change the character of it, but to the extent that you manage to keep out imports so your exports will fall off, and your power of competing with the world in the open markets will suffer accordingly.

Mr. Berry: You have listened to Mr. Hammond with a certain amount of interest. Mr. Hammond has given us his views, but I doubt, personally, whether Mr. Hammond has ever manufactured anything in his life in this country. His views are none the less interesting to you, no doubt.

Mr. Hammond: Pardon me, that is not so. I founded the Leeds Steel Works, and I was a manufacturer for many years.

Mr. Berry: Of course, I am open to correction, Sir. The question is one which is vital to the electric manufacturing industry, and it is the manufacturing electrical industry on which we must all prosper—consulting engineers, architects, the allied trades, electrical contractors, and so forth. Without the manufacturing industry we cannot do anything to compete with the importers, and we shall all have to be consulting engineers engaged in erecting things brought from abroad. Mr. Hammond, possibly, would not like that. Well now, gentlemen, at a temperance meeting which took place in London, a poor, down-trodden victim of intemperance made his way on to the platform, and when he was asked by the chairman as to what he could have to say in the interests of temperance, he said, "Not much, but I should like the audience to know that I am a terrible example." Now, gentlemen, having regard to this question of Free Trade and its effect upon the electrical industry, I want to introduce myself to you as one of those "terrible examples." That I have in latter days, I think, achieved a slight measure of financial success, is due entirely to the fact, in spite of Free Trade, that I have found my patents protected in this country by the medium of the Patent Office. I had previously to that been through the mill, and very nearly succumbed in competition with foreign countries. I started and equipped electrical works for making a speciality which is known to you all, and I choose this particularly to refer to, because it is one which is well known to you all. I refer to the little patent electric lampholder, which, I believe, was the invention of Mr. Swan, who is known to you all. Let us trace the history of that practical invention. There were world's patents held for that, and up to a period, the whole of the manufactures were in this country. When the patents lapsed, I, who had been the licensee, thought that, with other things I wished to manufacture, it would be a very fitting opportunity to start a works, and endeavour to get a livelihood. Well, due to the fact that foreign competition was against me, and they had their own markets and ours, it was utterly impossible, and prices came down, until it came to this, that I was one of the ruins out of which Mr. Kingsbury wishes that some Phœnix should arise. I should just like to read you an extract from Mr. Kingsbury's speech, to show you the utter inconsistency of the remarks which he has made respecting the manufacturing electrical industry. Mr. Kingsbury says, "Our Free Trade policy permitted us to apply at once any advance made elsewhere, and to give the industry a start on the most economical lines. So soon as the demand became large enough to permit economical manufacture, we abandoned imports and manufactured for ourselves. Our imports, in all probability, afforded a profit to the exporters. You Protectionists grudge that profit to the exporters; you think it was a loss to this country. I see in it an enormous gain. By reason of our more settled conditions our development in some departments was necessarily slower than that of some other countries. We were able to make a start at once in any applications not originating with ourselves. We were able to adopt the most suitable instrumentality, and obtain the benefits of its successive improvements at small cost. Protection would have delayed us for years and enormously increase the cost." How ridiculous that is! On the contrary, we started with something of which we had the market, and yet, if I am correctly advised to-day, of the millions and millions of holders which come into this country we are making about 20 per cent. of them only. Here was something where the foreigner entirely upset Mr. Kingsbury's theory—they actually came in and collared our speciality, and are to-day supplying it to the extent of 80 per cent. That is all very well no doubt; somebody is getting their holders cheap, and all this sort of thing, but in the meantime what about the people who are thrown out of work; what about the wasted capital—the capital that I wasted and my friends wasted? I want as speedily as possible to pass to the next point—Mr. Kingsbury on dumping. Mr. Kingsbury makes this startling statement:—"I venture to submit that it is unbecoming a great commercial nation with a world-wide trade for any section of its traders to endeavour to limit the freedom of the individual by the creation of a public sentiment based on international prejudice." Does it not occur to you, gentlemen, that Mr. Kingsbury appears to skilfully miss the point every time? In this connection I want just to tell you of a true anecdote which Mr. Kingsbury's speech forcibly reminded me of. Many years ago, I think it was in the early Victorian days, a certain Prime Minister had occasion to visit Ireland on State matters, and there was a banquet which he attended, at which he made some unfortunate remark. He was challenged to a duel, and when he attended on the ground the following morning, it so happened that the gentleman with whom he had to fight was a man of about twice his stature. The gentleman who gave the challenge said: "Sir, this is all very well, but this is a very unequal contest, you have got twice the amount of body to shoot at that I have got." "All right," said the Prime Minister, "I will agree that we should chalk a line upon your body the size of my own, and any shots which hit outside the mark shall not count." Well, gentlemen, that appears to be the whole basis on which the Free Traders argue. They lose sight of the fact, and will not open their eyes to the fact, that we are not fighting an equal battle. We are always finding we are fighting against someone who is hitting below the belt. I must confess that I am, politically speaking, weary of these figure-twisters, these jig-saw politicians who take out a figure here and a statistic there and a Board of Trade return from somewhere else and try and piece the whole thing together with a sort of "Hail! Smiling Morn" expression on their faces, and try and make out a picture depicting happiness out of your misery, or something of that sort. In the meantime, gentlemen, what are our Continental friends doing? Here, gentlemen, is the point. What are our Continental friends doing in the meantime? They send their Mr. Oppenheimers to come on the platform here and confuse us with talk about hay, when he should, perhaps, have mentioned thistles. And, gentlemen, in the meantime what is Mr. Oppenheimer doing? Well may he laugh up his sleeve to-night and call on you in the morning for your orders.

Mr. Oppenheimer: Mr. Oppenheimer is a *bona fide* manufacturer in this country, and has been connected with the electrical trade for 40 years.

Mr. Berry: In conclusion, I should like for a moment to accept the Free Trade position, and I would like to appeal to the sporting instincts of Free Traders. If they really believe these rumours we hear of, the foreigner living on black bread and offal, and of the starving families, and that the Americans, Germans and French are all starving, whilst we are prosperous, then I would appeal to their sporting sense, and say, "Just put a little tax on their goods, it it is only for the sake of fighting them on even terms, and feeding their starving families."

Mr. W. G. Bond: I consider it a very great privilege to be allowed to occupy nine minutes of your time. Also I hope to be able to save Mr. Kingsbury some portion of time in making a reply to some of the speakers. Mr. Garcke referred to some of these statistics which the last speaker did not like, and he referred to the rather lugubrious remarks made by Sir Alfred Bateman in 1902. Now, I have got some figures in front of me, and they are Board of Trade returns. It seems that in seven years, since 1902, this dying country increased its trade by 19 per cent. I don't think that is so bad. Then Mr. Garcke added that we

were not making any profits. Well, then again I have in front of me official figures. Schedule D of the Income-Tax Returns, trades and occupations, and I find the profits have gone up from 487 millions to 508 millions—that is about 5 per cent. These are the figures of 1902 against 1908, the latest figures which I have got. Then, again, Mr. Garcke seemed to think it was very wrong when we imported. I am sure if he will look carefully at the figures over a long period of years, that he will find that the years of greatest imports coincided with what are commonly known as "boom" years. At any rate, we will assume that imports are all wrong, and that exports are the thing. In that connection, I can only say that I have in front of me the figures for 1908 of the exports per head of the population, and I find that the English exports per head were £9 10s; the German exports, £5 8s. I don't think that that is such a very bad showing, after all. Now I have occupied four minutes of my nine, and now I come to the remarks which I wish to make to you on my own. Every speaker nearly at this meeting and at the last, said something of this kind—he got up and made out that he was an out-and-out Protectionist, and ended up by saying that really he was a Free Trader. There are enough contradictions and difficulties in this question, without adding unnecessary ambiguity to it. What is a Free Trader? There is no mystery about it; a Free Trader is one who would impose taxes for revenue purposes only. That is the whole thing. The Protectionist is a gentleman who would impose taxes for revenue purposes—because, of course, he must get revenue—but for other purposes as well; and motive is the whole difference between the two classes. The Free Trader is loath to put taxes on imports, because, as a rule—not always—such taxation frequently has a Protective effect. On the other hand, a Protectionist Government is bound to tax imports; that is what it lives for, it is an imperative necessity that it should tax imports, and in order that the taxation of imports may fulfil the two-fold object that the Protectionist has in view—that is, raising revenue and affording protection he puts on—he is driven to it—heavy duties on foreign manufactures, and he begins by putting on light taxes on food, but that is not the end of it. If the landed interest happens to be as powerful as it is in Prussia, and as it is here, the landed interest immediately says, "We must have heavier taxes on food," and so the unfortunate Government is driven against its will and against the will of the manufacturer—you see it all around you—I am not talking theory—to impose heavier and heavier taxes upon the necessities of life; upon the raw materials of the workman, and then when they have got to that position the manufacturer begins to squeal. He says—"You are running up the cost of labour, I cannot stand that." I can quite understand why he cannot stand it, and so the merry game goes on. I will quote some utterances from the other side to show you that this is no fancy picture. I will quote from the *Morning Post* of a fortnight ago. Talking of Germany, it said:—"With its high prices for necessities, its poor wages, its heavy rates, its vast army, and its ever-increasing navy, Germany would be in a parlous condition were it not for the thrift, capacity and industry" of the manufacturers—no, of the Haustrau. Yes, that is where you get to, and I strongly advise the Protectionist party—other people have introduced politics and I will, therefore, go as far as to say that I strongly advise the Protectionist party—to steer clear of "Votes for Women." There is another point which I would commend to your earnest consideration, and it is this. We hear a lot of talk about a scientific tariff, and I honestly believe that a large number of speakers on the Protectionist side, by dint of speaking it and repeating it, have come to believe that if only they were granted a Protectionist Government, they would get that scientific tariff, a tariff absolutely accurately adjusted to individual interests—we will leave the consumer out of the question. Again, I won't talk theory—I am not ashamed of theory, but I won't talk it. Does anyone mean to say that what happened a few months ago in Washington was a scientific adjustment to the needs of each industry? Why, it was the industry which held the most power, with the longest purse and with the best organisation, that got the biggest slice of the Tariff pie. Do you mean to suggest that the electrical industry is in that position here? If not, your relative position might be considerably worse. I grant you, as I think Mr. Hammond said just now, if you alone got the tax, manufacturers in the electrical industry would be bound to score; but you won't, and unless you by good means or by evil can influence the Legislature in your favour in the ignoble scramble for assistance out of the public funds you will come off worse. Even in America, at the last revision of the Tariff, what happened? The boot manufacturers of Massachusetts begged to be left unprotected if only they were given free imports of leather, which the Protectionists in this country have promised to tax at Bermondsey, and at Nottingham have promised to let in free. I assert further without fear of contradiction that you cannot protect any sensible proportion of the people of this country. When you talk of protecting the manufacturers, whom do you mean—the heads of the firm, or do you mean the workmen? (Cries of "The workmen.") Very well; are you going to pay them better wages. (Cries of "Yes!") All right; how, then, can you keep down the cost of production? Mr. Byng just now talked about competing with lower wages. But how are you going to protect the bricklayer, the plumber, the house-painter, the fisherman, the quarryman, the bank clerk, the schoolmaster, the doctor, the barrister—what about the shop girls, the waitresses, the laundresses, the lady typists, &c.—how are you going to protect them, in what shape will they get some of this golden stream that is going to come from Protection? At the last meeting a gentleman got up and quoted at great length an article from a German encyclopædia of 40 or 50 years ago, and he made this remark, "Every word of it is absolutely true." I am now going to quote, not from a German encyclopædia, but from a Scotch professor, Adam Smith by name, and I say that every word he says, although it is not very pleasant, is absolutely true, and this is what he says: "In every country it always is, and must be, the interest of the great body of the people to buy whatever they want of those who sell it cheapest. The proposition is so very manifest that it seems ridiculous to take any pains to prove it, nor could it ever have been called in question had not the interested sophistry of merchants and manufacturers confounded the commonsense of mankind. Their interest is in this respect directly opposed to that of the great body of the people."

(To be concluded.)

ELECTRICITY IN FACTORIES.

[COMMUNICATED.]

ONE of the duties of the engineer in charge of a system of electricity supply which is located in an industrial area is to make himself familiar with the conditions under which power is used in the workshop and factory, and to get to know the point of view from which the supply of power is regarded by the owners of such works. As a general rule it will be found that dense ignorance prevails as regards the costs and methods of operation in regard to power supply, and when the works foreman or even the manager is confronted with such a mysterious thing as electricity, the state of confusion becomes considerably worse. Under the circumstances, anyone who has for a few years been in the habit of inspecting and arranging for electric motive power installations to be run from the mains of an electricity supply authority, will develop a somewhat special knowledge of motive power users and their troubles. It may, therefore, be of interest to make one or two notes regarding actual cases of trouble which have occurred in factories where electric power is used, in order to indicate, without any attempt at classification, the kind of difficulty which the motive power supply man meets.

It is of extreme importance, in the first place, that when a motive power installation is put into a works, the apparatus should be of a satisfactory character, and should also be efficiently installed. This, of course, is not altogether in the hands of the supply authority, as works managers are to a large extent in the habit of ordering their plant themselves, but it is advisable for the supply authority's representative to keep as in close touch with details as possible in order to render expert advice. Some authorities go so far as to hire, or hire-purchase, plant in order to ensure that the machinery installed is of the proper character. A case in point occurred in a factory supplied from a central station, in which there were various motors operating the different processes. For some time this installation ran with complete success, but considerable trouble began to be experienced with regard to continuity of supply. Frequently, no current was available at the motors, and the supply behaved in a most erratic fashion, first one motor being available and then another. On examination it was found that nearly all the soldered connections on the switchboard controlling the low-tension supply had become unsoldered. This was partly due, in the first place, to bad workmanship, but it was also because in a competitive tendering proposition, the design had been so cut down that current densities became abnormal, and this, combined with the action of the vapour to which the board happened to be exposed, led to excessive development of local heat and the loss of the solder. It was, however, fortunate that the cables had up to the moment of inspection kept their position, as otherwise a serious short-circuit or earth could easily have been caused. All the connections had to be examined, and nearly all resoldered.

A rather curious incident occurred in a works connected to a system of supply, owing to the fact that one of the smaller motors supplied to the establishment was defectively insulated. The fault was not discovered until, owing to a period of stagnation in trade, the works shut down a portion of its plant for a month, and used no current at all. The curious part about the matter was, however, that the meter

for that section had gone forward considerably, and the power consumer not unnaturally complained. The meter man tested for the trouble, and found that, according to the revolutions of the meter when only the supposed earth was in circuit, there was a leakage of certain value, while according to the monthly loss of Board of Trade units, divided by the number of hours in the month, it equalled a less value, and obviously, therefore, the earth was intermittent. The motor, being small, was, unfortunately, controlled by a single-pole switch, and the meter was on the other pole. It therefore became probable that the trouble existed in part of the windings of the motor, and the customer was asked to call in the manufacturer of the motor in order to locate and remove the earth. As a matter of fact, it was found that the combined effect of defective insulation and damp caused a varying resistance, giving an intermittent contact to earth. This weakness in the electrical apparatus provided by the contractor might easily have caused considerable friction between the consumer and the power supply authority, had not the matter been promptly investigated and rectified.

While upon the subject of metering, it is interesting to note a very curious case which occurred in connection with a two-phase power supply. A small factory had a motor which was fed from the two-phase main, a meter being placed in each phase. When the motor was set to work, however, it was found that one meter went forward and the other went backward, and this caused a considerable amount of suspicion as to the reliability of the metering arrangements on the part of the owner of the premises. For this reason the matter was very carefully investigated and a full explanation was eventually found. Owing to the peculiar lay-out of the factory one phase of the motor was fed from a point a few yards distant through a cable of ·1 sq. in. cross-section. On the other phase, however, it was fed from a tapping point more than a furlong away by means of a cable only half this cross-section. As the power was supplied to the motor at a low pressure, there was a big difference in voltage on the two phases at the motor terminals, and on certain loads it appeared actually that the motor generated in one phase and motored on the other, giving rise to the erratic behaviour of the meter. A somewhat analogous case occurred in connection with an important installation in a dye works which was also operated from a two-phase supply. The meters, one of which was placed in each phase, had always operated correctly until a certain date, after which one meter registered forward and the other back. On investigation being made into the matter, it was found that, owing to overloading, a motor had been burnt out, and had been partially rewound by a local contractor. This rewinding had, however, destroyed the balance of the phases, and this caused one meter to run back. In order to overcome this difficulty, it was decided to install a two-phase meter taking simultaneous account of the energy distributed to both phases of the motor, as it was not judged necessary to take the machine out and entirely rewind it.

It is as well for the power engineer to keep an eye upon the general arrangement of a factory electrical installation at the time when this is being installed, in order to make sure that no bad arrangement of plant is put into effect which would militate against utility of electric power supply. The importance of wisely arranging the position of motor starting switches and resistances is almost too great to need much remark, but a case in point in some paper mills may be interesting as an example. It will be known that in the case of motors driving ventilating fans in such works, any stoppage of the fans means that the temperature of the room may be raised to such an extent as to utterly spoil the paper in the course of manufacture. In a case of this sort the power supply to the mill was cut off for a moment or two, causing all the no-load release coils on the motor starting switches to operate, and all the switch handles of the starting resistances to fall back to their "off" position. This accident, unfortunately, occurred during the night, as the mills were running double time. The electrician in charge of the works happened to be in bed, and those in charge at the time, after restoring the main supply, forgot to go round to the various auxiliary motors and start them individually, with the result that a considerable amount of valuable paper was spoiled. This would probably not have occurred had the power-plant designer foreseen the importance of grouping all the starting switches of important motors under one central control, so that an attendant could operate the various electrical processes from one central position, or, at any rate, would be able to obtain an indication at the main switchboard, as to whether each important piece of electrical apparatus was performing its functions properly.

The unskilled attendant in a factory is not only a person of zero value where electrical operations are concerned, but he very often exercises an adverse influence of considerable magnitude on the fortunes of the electricity supply authority entrusted with the provision of power to a factory. An instance may be taken from a visit of a power engineer to the works of a large consumer, which narrowly averted inevitable accident at a future date. During the visit, distinct traces were found of that unqualified nuisance, the amateur fuse replacer. The power consumer in question had several large motors in the factory, and at some time or another the attendant had apparently experienced some difficulty in maintaining his fuses on account of the fluctuating nature of the work on the motors. In order to make sure that the fuse should be amply sufficient to meet all requirements, it appeared as if the attendant had taken a reel of No. 18 copper wire and had wound it around the terminals until either his arm was tired or the reel had become exhausted. The power engineer drew the attention of the owner of the works to the grave danger which he was running in thus over-fusing his motors, with the result that the fuse capacity of some of the machines was cut down to one-tenth of its former value.

There are other incidents in factory operation by means of electricity that appear to be quite beyond the foresight of even the most experienced power engineer. For example, in a refuse destructor, in which an electric power supply was introduced in order to operate some of the machinery, there was installed a magnetic sorter, for the purpose of separating out pieces of scrap iron from the refuse. This sorter is a revolving drum with periodically magnetised studs upon its outer periphery. The scrap iron is picked up by these studs, which, at a certain point in the rotation of the drum, become demagnetised and throw the iron down a shoot. One day, however, the magnetic sorter picked up a long piece of iron wire which adhered to the drum and refused to let go at the proper moment. After twisting about in an erratic manner, one end got into touch with the live terminals forming the connections of the machine, and this gave the sorter attendant a very lively and unpleasant five minutes, by making all the scrap iron within reach alive at a pressure of 200 volts. The machine was promptly shut down and the iron wire removed, and as the result of this experience the terminals were very carefully encased, so that no particles of iron, even down to the filings, could get at them.

In conclusion, one other function of the power engineer in a system of electric power supply may be mentioned. He is virtually the watch dog on the efficient performance of the duties of all other parts of the electrical system, insofar as their proper operation affects the interest of the power consumer. This is interestingly brought out by an experience which occurred in connection with a man who discovered that he had an earth on one side of the supply system feeding his works. Apparently the supply authority had not detected this on the Board of Trade panel. In any case, they had allowed the earth to remain for some time, and the power consumer in question, being something of an electrician himself, discovered that the earth came on the side which passed through his meter. For some time, therefore, this ingenious consumer lit one of his workshops by connecting his lamps on one side to the bus-bar of his distribution board which was not connected to the meter, and on the other side to a water pipe. Naturally, the current used for the illumination of this particular shop did not go through the meter, which did not at all disturb the peace of mind of the consumer, and would probably have remained as it was but for watchfulness of the power engineer. Even when the fault was discovered it could not be demonstrated that the consumer was breaking any of the supply authorities' regulations.

BUSINESS NOTES.

Darlington Turbo-Generator.—Referring to the article in our issue of May 27th on this generating set, we are informed that the dynamo was manufactured by MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Caxton House, S.W. The speed of the set is 1,850 R P.M., not 850, as stated.

Osram Candle Lamps.—THE GENERAL ELECTRIC CO., LTD., are now producing their standard pattern 10-c P. Osram candle-shape lamps, 25, 33, 50 and 55-volt, in a globe measuring 26 mm. in diameter. The shoulder of the cap measures 23 mm.; the lamp is therefore suitable for using in practically all designs of candle fittings. The price remains as before. The altered appearance of the lamp may be seen from the illustration.

German Electrical Exports to South Africa.—We extract the following figures relating to German electrical exports to South Africa in March, 1909 and 1910 respectively, from the *British and South African Export Gazette*:—

	March, 1909. Tons.	March, 1910. Tons.
Electrical machinery ...	41	1,078
,, apparatus ...	16	185
,, cable ...	5	159

There were also very large increases in wrought-iron, ironware, in railway material, and in colliery machinery.

Electric Irons.—We learn that it has been decided to replace the gas-heated irons in a considerable portion of the Royal Army Clothing Department, Pimlico, with electrically heated irons. The tender of MESSRS. EASTMAN & WARNE for irons of their patent "Hot point" type has been accepted.

Commutator Compound.—We have received from the NATIONAL ELECTRIC COMPOUND CO., of 11, Pratt Street, Camden Town, N.W., a sample of their dressing for commutators—a black waxy material, for which high qualities are claimed in the accompanying leaflets.

Spain.—An American Consul in Madrid reports a good market in Spain for pumps "if they are properly pushed." "There appears to be an especially good outlook for electric pumps suitable for lifting water to the tanks on the roofs of the tenement and apartment houses that abound in Madrid. A large portion of the city is on hills as high as the reservoir, and there is not pressure enough in the city mains to raise the water above the first floors. All the houses in this, the best residence section of the city, are equipped with tanks on the roofs, to which the water is lifted by electric pumps. Building is progressing rapidly in this city, and there will certainly be a good market for some time to come." The Consul remarks that "any one of the three leading dealers in pumps in Madrid will accept an agency for American pumps, in case they are convinced that the goods will compete with those from European countries. These dealers may be addressed in English. There is no market here for any sort of gasolene engine on account of the high price of gasolene."

Italy.—British Vice-Consul Ogston in reporting from Spezzia draws attention to the fact that during 1909 only two representatives of British firms called at his Vice-Consulate, one of whom went home with very satisfactory orders. The only language used there is Italian, though a little French or German is sometimes spoken. English is quite useless; consequently the commercial traveller who speaks only that language will not accomplish much. As the openings for trade are not always very obvious, and appear in unlikely ways and places, the traveller who thinks he knows all about everything beforehand is likely to be disappointed in his efforts. For similar reasons catalogues, however well got up, in the English language and with all calculations in English weights, measures and coinage, are almost useless. British goods are often too good. The average citizen of a town such as Spezzia would gladly buy British wares, but has not the ready money to do so, and it suits him better to buy German or Austro-Hungarian goods of inferior quality and price twice within a given time, than to buy British goods once which would last twice as long as the others, even though the total expenditure under the former method is greater than under the latter.

Book Notices.—*Data on Illumination.* Bulletin 7B, May 2nd, 1910, of the Engineering Department of the National Electric Lamp Association, Cleveland, Ohio, U.S.A.—This excellent bulletin gives a *résumé* of the requirements and methods of good illumination, data for calculations, worked-out tables relating to "Mazda" lamps, and other information indispensable to the illuminating engineer.

Reduction of Working Costs on the Rand.—London: *Investors' Guardian*, Ltd. Price 1s.—This is a reprint in book form of a series of articles published in the *Investors' Guardian* by its Special Commissioner, on his third visit to the Rand. The marked reduction in working costs—from 25s. 9d. per ton in 1902 to 17s. 2d. per ton in 1909—is ascribed partly to the increased efficiency of the native labourer and to the employment of heavier stamps and tube mills, but also to some extent to the increased use of electricity on the Rand, which will become an increasingly important factor in producing economy in both working and capital expenditure. One of the results of the reduction in costs is that the life of the mines has been materially prolonged, as it has become possible to work ore of a grade hitherto found unremunerative.

"*Report* of the Council of the City and Guilds of London Institute." 1910. London: Gresham College.—The report states that progress has been made towards concluding an agreement for the combination of the engineering departments of the Imperial College and the Central Technical College under a joint committee. The Goldsmiths' Company have presented £50,000 towards the extension of the department, and the Institute has decided to extend the engineering workshops over the remainder of the site available at a cost of £5,000, together with £3,000 for the fittings and equipment. The subject of military training is referred to as highly desirable for engineering students, and it is stated that in addition to the Corps of Electrical Engineers and the Rifle Clubs, the Officers' Training Corps of the University of London has enrolled more than fifty of the students of the Central Technical College. The appointment of Mr. T. Mather, F.R.S., to the full Professorship, in succession to Prof. Ayrton, is recorded. The transfer of the elementary classes to the Royal College of Science has enabled the engineering work of the Central Technical College to be developed in various directions, and more original research work is now being undertaken. The Civil and Mechanical Engineering Course, which from 1887 to 1896, and from 1901 to 1905, was surpassed in point of numbers of students at the C.T.C. by the Electrical Engineering Course, now attracts by far the larger number, partly on account of the depression in the electrical industry, and partly on account of the wider scope and greater opportunities of the former. The C. and M.E. Course, in fact, in 1908-9 had 227 students, and the E.E. Course 113. In 1898-9 the numbers were respectively 112 and 83; and in 1888-9, 31 and 41. The number taking the Chemical Course remains about the same as 15 years ago—26 in 1908-9. There were in all 469 students on the roll in 1908-9. The Siemens Memorial Medal and Premium in Electrical Engineering was awarded to F. H. Bramwell. Last year 42 students of the C.T.C. obtained the degree of B.Sc. (Eng.) in the University of London. Further progress has been made with the equipment of the new Engineering Laboratories of the Technical College, Finsbury; in 1908-9 there were 67 day students following the Electrical Engineering Course, and 71 the Mechanical Engineering Course, out of a total of 182, and there were 291 evening students. Referring to the Department of Technology, the report points out the necessity, notably in Electrical Engineering, of obtaining instructors with a practical as well as scientific knowledge of the subject. The total income of the Institute for the past year was £46,325, and the total expenditure £46,932. The expenditure at the Central Technical College was £20,896, of which £14,055 was recouped in fees.

In the Department of Technology the number of students and candidates for examination in electrical subjects shows a uniform rise. In telegraphy and telephony there were 1,580 (1,541) students; in wiremen's work, 1,043 (816); in electrical engineering, 4,806 (4,455); and in electro-metallurgy, 162 (140), the figures in brackets being those of the previous year. The results in telegraphy, and in the first year's wiremen's work, show a great improvement in the quality of the work, but in telephony and electrical engineering the results are not satisfactory, bad teaching being responsible for many of the failures.

"Miscellaneous Tests of Electric Car Equipment." By E. C. Parham & J. C. Shedd. 1910. London: McGraw-Hill Book Co. Price 4s. 6d. net.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVI, No. 5. May, 1910. New York: The Society.

"The School of Mines Quarterly." Vol. XXXI, No. 2. January, 1910. New York: Columbia University. Price 50 cents.

"*Bulletin* of the Association des Ingénieurs Electriciens." March, 1910. Liége: The Secretary.

"*Journal* of the Western Society of Engineers." Vol. XV, No. 2. April, 1910. Chicago: The Society. Price 50c.

"*Journal* of the American Society of Civil Engineers." Vol. 32, No. 6. June, 1910. Baltimore: The Society. Price $1.

"*Annuary* of the American Institute of Architects." 1910. Washington: Gibson Bros.

"*Proceedings* of the American Institute of Architects." December, 1909. Washington: Gibson Bros.

Messrs. Harper & Bros. announce for publication during June the following electrical handbooks:—"Electric Trains," by H. M. Hobart, M.I.C.E., 6s. net, and "Continuous-Current Machine Design," by Wm. Cramp, M.I.E.E., 5s. net.

Bankruptcy Proceedings. — *Re* THOMAS WARD, formerly of Totteridge Road, Enfield West, late a director of the Electrical Instrument Manufacturers, Waltham Cross.—At the Edmonton County Court application was made by Mr. Mellor, counsel on behalf of the debtor, for the adjudication order granted by the Registrar against the debtor to be rescinded. Mr. Mellor explained that the Receiving Order was dated September 28th, 1908, and after many adjournments in consequence, mainly of the debtor's ill-health, the public examination was concluded on April 13th, 1910. The Official Receiver applied to have him adjudicated bankrupt, and this was opposed by the debtor's solicitor, who said that it was intended to put before the Court a proposal for a composition, or scheme. There was no evidence forthcoming on the subject, and the Registrar made the order of adjudication, but he

stayed the advertisement for a period to allow the debtor to take any further steps in the matter if he were so advised. The debtor approached a friend named Murch, who had now offered to provide sufficient to pay 7s. 6d. in the £, and also the Official Receiver's costs, on condition that the adjudication was not gazetted. Counsel suggested that an opportunity should be given to the debtor to put forward a proposal so that it could be considered by the creditors. Mr. F. T. Garton, the Assistant Official Receiver, in opposing the application, pointed out the delay there had been in connection with the case, and questioned the *bona fides* of the offer. His Honour suggested that it would be sufficient to continue the stay of the advertisement, without rescinding the adjudication, until the offer had been considered. Mr. Mellor agreed, and the application was, therefore, postponed until July 2nd upon that understanding.

John Patrick Leo Donlevy, consulting electrician, 123, Tulse Hill, Surrey.—Order made on June 3rd, on a creditor's petition. First meeting, June 16th; public examination, July 14th; both at Carey Street.

Platt & Bleasdale, electrical engineers, Bolton, also R. Bleasdale, separate estate.—June 28th is the last day for the receipt of proofs for dividend to be received by Mr. Harold Mather, 10, Acresfield, Bolton, the trustee.

A. H. Gibbings, engineer, Liverpool.—Application for debtor's discharge is to be heard on July 1st, at the Court House, Government Buildings, Victoria Street, Liverpool.

W. H. Trentham, electrical and consulting engineer, 39, Victoria Street, Westminster, and Warlingham.—Under a receiving order made recently in the London Bankruptcy Court, Mr. Egerton S. Grey, Official Receiver, said it appeared, from the debtor's statements, that he had carried on business for 15 years, partly alone and partly in partnership. The practice was principally in connection with electric lighting and sewage works. It was successful up to 1904, in which year the net profit amounted to £3,000; but since then, owing to decline in electric lighting work, the practice had fallen away very considerably. The debtor estimated his liabilities at about £6,000, of which £4,200 was in respect of Stock Exchange speculations, and practically no value whatever was placed on the assets. Prior to three years ago, the debtor had lost largely by speculating in the American market, to which losses, to want of capital, and the adverse decision in a partnership action, the failure was ascribed. In the absence of any offer, the case was left in the hands of the Official Receiver to be wound up in the ordinary course of bankruptcy.

Dissolutions and Liquidations. — Littlewood, Beaumont & Co., electrical and motor engineers, Thirstin Ironworks, Honley, near Huddersfield.—Messrs. J. A. Littlewood and F. H. Beaumont have dissolved partnership. Mr. Beaumont will attend to debts.

Trentham & Saunders, consulting and civil engineers, 39, Victoria Street, London, S.W.—Messrs. W. H. Trentham and James & John Saunders have dissolved partnership. The Messrs. Saunders will attend to debts, and continue the business as Saunders & Saunders, at the same address.

The Equipment and Engineering Co., engineers, Northampton Park, Canonbury, London.—Messrs. A. K. Baylor, E. E. Daglish, W. L. Lorkin and H. Brittain have dissolved partnership, Mr. Brittain retiring. The remaining partners will attend to debts and continue the business.

Electric Sterilising, Carbonising and Stripping Co., Ltd.—This company is winding up voluntarily, with Mr. H. Appleyard, Prudential Buildings, Market Place, Dewsbury, as liquidator. A meeting of creditors is to be held on June 20th.

Catalogues and Lists.—Messrs. Alfred Herbert, Ltd., Coventry.—Twelfth edition of section "J" of the firm's catalogue just issued in their standard size and style. It consists of 58 pages of illustrated and descriptive matter relating to the Hexagon turret lathe. Particulars of recent improvements are given. The patent "Roller steady" tool and its action are dealt with, and particulars appear of the special equipment for the production of steel stay bolts.

Messrs. Holden & Brooke, Ltd., Sirius Works, West Gorton, Manchester.—Thirty-two-page pamphlet containing some pages of general notes on centrifugal pumps, their principles, design and construction, characteristics, balancing, installation and operation, followed by some particulars of the firm's own pumps, with tabulated data concerning friction of water in pipes, and power transmitted by rope and belt respectively.

Messrs. H. T. Boothroyd, Ltd., Bootle, Liverpool.—New 16-page descriptive list (N.E.-1910) dealing with the latest of the firm's N.E. type dynamos and motors, all of which have cast-steel bodies. The makers claim the machines to be light, strong, of small size, with high efficiency at varying loads. We understand that for these reasons a large number are installed in printing works, factories, &c., and for direct drive for all classes of machinery; large compressors and pump motors on the *Mauretania* and the *Lusitania* are of Boothroyd make, and a full set of circuit breakers have been recently installed for the *Lusitania* main switchboard. These breakers were designed specially to meet requirements on board ship.

Messrs. Charles Price & Son, Broadheath, near Manchester.—Twenty-eight page illustrated pamphlet (No. 4) showing their paraffin and spirit engines, lighting sets, railway inspection cars, &c.

The Power Plant Co., Ltd., West Drayton, Middlesex.—Twenty-page pamphlet relating to their machine cut double helical gearing for collieries and mines. They claim that this gearing greatly simplifies the adaptation of high speed motors to mining machinery, by eliminating most of the intermediate gearing hitherto required, and making it possible to do in a single reduction what previously had to be done in two or three trains of gearing. A list appears of colliery companies using these gears.

Messrs. Archibald J. Wright, Ltd., Leyton Green Road, N.E.—Several illustrated circulars and price lists relating to model aeroplanes, and parts needed in their construction.

Messrs. Crompton & Co., Ltd., Salisbury House, London Wall, E.C.—Eight-page pamphlet being an advance price list of the firm's moving iron electrical instruments for continuous and alternating-current circuits.

The B.T.-H. Co., Ltd., Rugby.—Folding leaflet describing their fusible cut-outs in iron boxes, and fusible cut-outs and fuses (cartridge type).

Messrs. Max Kohl A.G., Chemnitz, Germany.—Price list No. 50, Vol. 1, describing equipments for physics and chemistry class-rooms, experimental switchboards, projection apparatus and accessories, &c., with full particulars and prices. The list consists of over 200 pages, admirably produced, in English, with a full index.

Allgemeine Elektricitats-Gesellschaft, Friedrich Karl-Ufer, 2-4, Berlin, N.W.—Leaflet showing and giving prices of special motor-generators for cinematographs, converting from A.C. or D.C. to D.C., 65 volts, 30 or 50 amperes.

Messrs. Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.—Two price sheets, No. 518, briefly describing, showing and giving prices of central battery telephone instruments, No. 526 dealing similarly with telephone condensers. Well-bound illustrated price list of electrical supplies. Its 276 pages are divided up into sections by means of a thumb index, a key to which appears at the beginning of the book. There is also a general alphabetical index. Prices are boldly indicated, and most of the lines covered are illustrated. If we briefly mention the various sections we shall have indicated generally the contents of the book. The first five sections deal with tantalum and carbon-filament lamps, arc lamps and carbons, installation accessories, and conduits and conduit fittings. Then come six sections with various fittings, electroliers, pendants, hand and standard lamps, radiators and street and weather-proof fittings. Section XII relates to reflectors, holophane ware and shades; XIII, with wires and cables and "Stannos" wires; the remaining six sections covering switches, switchboxes and fuses, circuit-breakers, lightning arresters, instruments and meters, electric heaters and cookers, and electric bells, wires, pushes and batteries. This volume covers quite a wide range of manufactures used by electrical contractors, including a number of novelties, and they can be supplied direct from the firm's Supplies Department, 39, Upper Thames Street, E.C., or from the various branches. Tantalum focus lamps, "Ked" cartridge fuses of the latest type, with indicating window, the manufacture of which is being taken up at the Stafford Works, a special line of cheap knife switches, and the latest forms of horn lightning arresters, may be mentioned as among the newer lines.

Messrs Klaar & Schultz, Waldemarstr. 14, Berlin S.O. 26.—Catalogue and price list of new designs of electric lighting fittings, push buttons, reflectors, &c.

Mr. Sydney Smith, 215, St. John Street, London, E.C.—Leaflet relating to springs for electrical, tramway, cycle and general engineering.

Messrs. John Dugdill & Co., Failsworth, near Manchester.—Third edition of their illustrated catalogue (32 pages) of movable and extensible electric light fittings for factory, office, and house service, also shades, reflectors, and accessories. Prices are stated.

Electricity Committees and Coal Contracts.—A correspondent states that special efforts are now being made by electricity committees connected with many corporations in Central, East, and South-east Lancashire to obtain cheaper contracts with local colliery proprietors, and from all accounts substantial reductions will be conceded this month for next half-year's supplies. Keener competition is being engendered amongst Lancashire coal-owners in the matter of securing corporation contracts.

LIGHTING and POWER NOTES.

Accrington.—The Accrington T.C. has arranged a new sliding scale for users of electricity for power purposes. This ranges from 1·5d. per unit from 1 to 150 units per quarter, to 0·73d. from 19,801 to 25,000 units per quarter. Factories will be allowed the use of 5 per cent. of the total power units for lighting purposes.

Acton.—A special meeting of the Council was recently held to consider the following resolution of the Electricity Committee: "That this Committee, having carefully considered the position of the electricity undertaking, is of opinion that it demands the immediate decision of the Council thereupon." The chairman (Mr. P. S. Schultess Young) said he felt that the Council had come to a parting of the ways in regard to the undertaking, and any indecision or hesitation on their part to come to some determination would be playing into the hands of a very astute business company whom he could not help regarding as an enemy of the Council, namely, the Metropolitan Electric Supply Co. The Council had been twitted by official papers about not taking the advice of their experts, but

the expert advice of Sir Alexander Kennedy was conclusive, that except they got better terms from the Metropolitan Electric Supply Co., the undertaking could not pay. After a long discussion, a resolution that a special meeting be held at an early date to consider the report of Sir Alexander Kennedy on the position of the undertaking, and that there be included in that consideration the accountant's balance-sheet on the subject, and any other necessary documents, was unanimously adopted.

Aldershot.—The U.D.C. has applied to the L.G.B. for a loan of £2,000 for extensions of the electricity department.

Argentina.—La Société Electricité de Rosario is the name of a new company which has just been formed in Brussels with a capital of £700,000, to establish a large central electric generating station in the town of Rosario. Several of the large French, German and Belgian electrical concerns are interested in the new undertaking.

Atherton (Lancs.).—Mr. Astbury, the electrical engineer, in a report to the U.D.C., states that the present plant is fully loaded, and additional plant will have to be installed before next winter to meet the increasing load. The reduction in price, which was brought into operation 18 months ago, has had the effect of augmenting the demand, so that the undertaking is now in a much better financial position than it was a couple of years ago.

Barrow.—At the T.C. meeting, on Monday, Ald. J. P. Smith (chairman of the Electricity Committee), said as regards the year's working, that in spite of the bad times the revenue had increased from £12,900 to £13,200. While getting an increased revenue they had also managed, by increased economy, to reduce the expenditure from £6,280 to £5,880, a decrease of over £400. By taking the two figures together, they got an improvement of £768 on the working. During the year they had added some 5,000 extra lamps and 64 consumers. The total number of lamps was now about 83,000.

Bradford.—The T.C. has decided to extend the mains to the Eccleshill district, from which many applications for a supply have been received.

Braunton.—By the casting vote of the chairman, the P.C. has decided not to seal a contract for electric supply with the Edmundson Electrical Corporation, Ltd., but to first seek the advice of an electrical engineer on the scheme, under which public lighting is to be provided for £50 a year.

Bridlington.—The T.C. has decided to extend the electrical illumination on the Prince's Parade, at a cost of £200.

Camborne.—The U.D.C. has acquiesced in the scheme of the Cornwall Electric Power Co., Ltd., by which electricity is to be supplied by means of an overhead line from Hayle Harbour to Carn Brea.

Chile.—According to an American Consular report, a hydro-electric power plant of 4,000 H.P. was installed in 1909 on the Maipo River, near Santiago, at a cost of about $3,000,000. The plant will furnish light for the city, and power for such industries as may require it. The Government has granted a German company a concession to install an electric power plant on the Aconcagua River in the vicinity of Los Andes. This plant will supply power to run the Government railways between Valparaiso and Santiago, a distance of 114 miles, and also will provide light for the cities and towns along the way.

Canada.—A treaty has been signed by Great Britain and the United States, in which provision is made for regulating the use of water for power purposes at Niagara Falls. By the terms of the treaty the Canadian side is to be permitted the use of 36,000 cb. ft. per second, while the New York side will be allowed to use 20,000 cb. ft. per second. The amount allotted to the Canadian side will make possible a much larger development than is now in use, but as the developing companies are permitted by the Canadian authorities, as well as by the United States authorities, to transmit and sell in the United States at least half the power generated in Canada, the New York side is benefited by the Canadian development. The 20,000 cb. ft. allotted to the power companies on the New York side will make it possible for the Niagara Falls Power Co. and the Niagara Falls Hydraulic Power and Manufacturing Co. to perfect their developments as originally planned. It will also leave a small amount of water for use in Lockport, where one company has a development to effect which water is diverted from the Erie Canal. As considerable attention is paid to efficiency at Niagara, on both sides of the river, the water diverted may be expected to afford the highest possible results in power output that can be obtained with modern equipment.

At a recent Cabinet meeting which was largely attended by all parties interested, it was decided that there shall be no export of Fort Francis power to the American side. This means that the concern owning and managing the big pulp and paper mills at International Falls, Minn., will have to utilise the Canadian power on the Canadian side. It also means that there will now be available for use in Fort Francis 15,000 H.P. for industrial concerns.

The price of power is now being considered by the Hydro-Electric Commission of Ontario, which will use the authority vested in it by the Government to compel the power company to deliver power at the lowest possible rate.

The new and ready made town of Prince Rupert, B.C., terminus of the Grand Trunk Pacific Railway, has let contracts for steam and electrical apparatus, required by the new city, to the amount of $60,000. The equipment includes three tubular boilers, capacity 1,000 H.P.; two 175-KW. alternators; two Robb engines, condensers, pumps, piping, &c.

Canterbury.—The annual report on the working of the municipal electricity undertaking has just been issued. There has been an increase in the revenue account on the year of about £603, the figures for the year ending March 31st, 1910, being £9,369. The units sold to private consumers show an increase of about 7 per cent. Expenditure stands at £4,785, against £4,690. The gross profit for the year gives a return of about 7 per cent. on the amount of capital expended—the figures are £4,585. The net profit, after allowing for interest, income-tax, capital repayment and sinking fund charges of £4,023, is £562.

Continental Notes.—FRANCE.—La Société de Constructions Electriques du Nord et de l'Est of Jeumont is in negotiation with the Compagnie Parisienne de Distribution d'Electricite with reference to the establishment and equipment of a new central electric lighting station having a capacity of 60,000 KW.

BULGARIA.—Plans have been passed for the establishment of a central electric lighting station in the town of Baltschir.

DENMARK.—The city of Middelfort, on the Island of Funen, is contemplating the erection of a central station from plans drafted by a Copenhagen expert. The estimated cost is put at 160,000 Danish kroner.

Costa Rica.—The Government has recently entered into a contract with a private company for the lighting of the port of San José by electricity.—*Board of Trade Journal.*

Coventry.—The T.C. has resolved to have a system of street fire alarms installed at a cost of £1,282.

The following revised tariff for electrical supply has been adopted by the T.C.:—Energy for motive power, first 2,500 units per quarter, reduced from 1½d. per unit to 1¼d.; when the consumption is 50,000 units per quarter, a flat rate of 1d. for all current consumed. For energy for domestic purposes other than lighting, 1d. per unit.

Croydon.—The thirteenth annual report of the municipal electricity undertaking was presented on Monday. In reference to the more efficient lamps now used, Mr. Alex. Cramb states that though the net increase in consumers over two years ago was 617, the electricity sold for lighting purposes was only 18,000 units more. The estimated loss of revenue from this cause was £2,000, apart from which concessions to consumers were represented by £1,589. After charging interest, sinking fund and income-tax, a net balance of £10,466 remained, of which £4,000 was set aside as a contribution in relief of the general district rate. A considerable proportion of £5,256 expended on the revenue account—the professional auditors pointed out—might have been regarded as capital outlay. The reserve was brought to £34,907, which meets the maximum requirements of the L.G.B. The Committee recommended certain concessions to consumers, including the surrender of £674 in connection with street lighting. This, the chairman (Ald. Miller) pointed out, made a reduction of something like £1,000 in two years. The reserve on March 31st was £34,907, and £10,466 had been carried forward. Altogether £10,000 had been specially contributed to the relief of the rates. For various reasons, however, the future was not so rosy as might appear. The report and accounts were adopted.

Eastbourne.—The L.G.B. has sanctioned the borrowing of £1,835 for condensing plant.

Grimsby.—Application is to be made to the L.G.B. for sanction to borrow £4,000 to be expended during the next three years for the extension of mains, and £1,500 for services.

Japan.—It is announced from Tokio that the Japanese Vice-Minister of Communications has been deputed to visit the United States and Europe with a view to conducting investigations into the subject of hydro-electric generating stations.

London.—BETHNAL GREEN.—At the meeting of the B.C. on Thursday the Electricity Committee again recommended that the Council should adopt the Shoreditch B.C.'s alternative flat rate scheme for a period of seven years, and that under the direction of the Committee, all necessary steps should be taken to give effect to the resolution, obtain necessary consents, and report to the Council. To this the Council agreed.

The Shoreditch Council is to give a supply at one or more points on the boundary, the capital cost of distribution being undertaken by Bethnal Green, and the management of the supply, &c., by Shoreditch. The rates vary from 1·15d. per unit from 250,000-500,000 units per annum to 1d. per unit for 1,000,000 units and over.

L.C.C.—The net amount payable in settlement of the arbitration on the claim of the Westminster Electric Supply Corporation is £181,071; the costs of the taxed proceedings amount to £4,697. It has been agreed to accept an offer of £8,000 for the generating plant taken over from the Westminster Co.

Manchuria.—In connection with the extension of the Mukden electric lighting works which operate in connection with the Government mint, a 350-KW. G.E.C. (U.S.A.) Curtis turbine set coupled to a 50-period three-phase alternator is being installed, and will be running in August next. The supply is at 2,200 volts, transformed down to 110 volts for consumers' use.

Mirfield.—A sub-committee appointed for the purpose of inquiring into the working of the electricity department, reported that the continued loss on the undertaking was due to the general

use of metallic-filament lamps. It recommended that the price of energy for lighting be increased from 4½d. to 6d. per unit.

Newport.—The T.C. proposes extending the tramways and electricity systems at a cost of about £30,000, and this week a L.G.B. inquiry will be held to consider the Corporation's application for powers to borrow the money.

Nottingham.—The annual report of the electrical engineer (Mr. H. Talbot) states that there is a steady increase in the use of electricity for power purposes, 84 motors aggregating 349 H.P. having been installed during the year, bringing the total up to 1,040 motors and 4,169 H.P. The number of units sold during the 12 months was 11,469,735 made up as follows:—For lighting, 3,893,241; power, 2,164,277; traction, 5,412,735. This showed an increase of 16,929 units. The average cost obtained per unit was 1·89d., as against 1·92d. in the preceding year. The total works cost was ·99d., the same as in the preceding year; the cost, however, in the year before that was 1·01d Although there are many additional users of electric light, there is a still further decrease in the number of units sold for lighting purposes, due to the increased use of metallic-filament lamps.

Peterborough.—At the monthly meeting of the T.C., the town clerk reported that the revenue from the Corporation electricity works for the year, amounted to £7,087, and there was a surplus in the working account of £3,216. The capital charges and special charges came to £5,017, of which the costs of the recent arbitration case with the Peterborough Electric Tramway Co. were £1,016, thus leaving a net deficiency on the year's working of £1,801, as compared with last year's surplus of £89. Councillor T. C. Lamplugh, J.P., asked for an explanation of the deficiency, and also for information on other points. For instance, the provision for repayments was £1,846 19s. 4d., a very much larger sum than that of the two previous years. Moreover, where did the deficiency of nearly £700 more than the previous year come in? That was allowing for the costs of the arbitration case. The city engineer said there was the sum of £268 refunded under the arbitrator's award to the tramway company for the period prior to April 1st, 1909; the supply for lighting had suffered from the introduction of metal-filament lamps.

Preesall.—Mr. E. Swarbrick, of Leigh (Lancs.), has asked the U.D.C. to support him in undertaking the electric supply of the district without obtaining Parliamentary powers. The Council has intimated that it has a lighting scheme of its own under consideration.

Rotherham.—The T.C. is to apply to the L.G.B. for sanction to borrow £27,832 for the electricity undertaking. The chief items are as follows:—Extension of mains and transformers for distributing purposes, £10,000; one 1,000-KW. turbo-alternator, condensing apparatus and switchboard, £5,000; 3½ miles high-tension feeder cable, £6,175; feeder and distributor mains for supplying the Broom district, £2,222; one 250-KW. rotary converter set, one 250 transformer and high-tension switchboard (all for generating station), £1,050; Ditto, at Howells, Wincobank, £975.

St. Annes.—The U.D.C. is applying to the L.G.B. for sanction to borrow £3,000 for the erection of a chimney and for other work in connection with the electricity undertaking.

St. Helens.—The report of the year's working of the Electricity Committee is highly satisfactory. Thirty-two new consumers, representing 438 KW., were connected during the year. Energy sold amounted to 2,779,464 units, an increase of 294,833, or 12 per cent. over the previous year. The income was £20,142; increase, £609. Working expenses had been reduced to £9,736; decrease, £20. The gross profit was £10,046, a return of 6·35 per cent. on the capital. After paying interest and sinking fund there was a surplus of £1,031, £600 of which has been credited to the plant renewal and accident funds, and £431 to reserve. The cost of production had, by economies, been reduced from ·77d. to ·66d. per unit.

Sheffield.—In view of the greatly increased demand for energy for power purposes, particularly for supplying electric furnaces—two of which have been connected up, and others are awaiting connection—the Corporation is proposing to spend some £78,000 in extending its Neepsend plant.

Smethwick.—The T.C. has decided to oppose the transfer of the E.L. order from the Birmingham and Midland Tramways Co., Ltd., to the Shropshire, Worcestershire and Staffordshire Electric Power Co.

South Africa.—Our Durban correspondent sends us a copy of a popular lecture delivered by the borough electrical engineer, Mr. J. Roberts, on "Electricity in Sanitation," in which is sketched an anticipation of the improvement which electricity is fitted to make in domestic and municipal life. Copies of this are sold at a nominal figure. Another new departure, believed to be quite novel, is the transmission of correct time to the clients of the electricity works. At eight o'clock exactly, the time being obtained from the Observatory, the pressure is reduced for about two seconds by about 15 per cent., just sufficient to be plainly noticeable, and the innovation has met with considerable public approval.

South Africa.—According to *African Engineering*, it is proposed that the three electric power stations in Lourenço Marques should be merged into one belonging to the Delagoa Bay Development Corporation.

Stevenage.—The B. of T. has asked the U.D.C. what steps have been taken by the undertakers to carry out the E.L. order, 1902. At the last meeting of the Council, when the matter was discussed, the clerk stated that the Manchester firm, which originally undertook the work, had not been in a position to carry out the order, and he advised that it would be best to have the order cancelled and apply for a new one.

Sunderland.—The annual statement of Mr. A. S. Blackman, the Corporation electrical engineer, has just been issued. It shows that there was during the year ended March 31st last, a net loss of £112. The revenue was £49,361, and there was a gross profit of £28,351; there had to be paid for interest £12,524; sinking fund, £15,518; and £421 for renewals, &c. Since the undertaking was commenced in 1895 the net losses amount to £9,006, and the net gains to £6,803. There has thus been a deficiency in the accounts to date of £2,203. Mr. Blackman says that the outstanding features of the year were a partial recovery from the depression in the shipbuilding and engineering trades; the commencement of the H.T. supply to consumers; the reduction of the price charged to the tramways for electrical energy to 1½d. per unit, representing a drop in revenue of £1,321 during the period under review; the introduction by the Home Office of new regulations which were necessitating alterations to portions of the works and sub-stations; the rapid introduction of the metal-filament lamp and the reduction in the sales for lighting purposes consequent thereon. The number of units sold in 1909-1910 was 7,848,815, as against 6,584,825 in the preceding year. The cost of production was 1·53d., as against 1·82d., a reduction of ·29d.

Swansea.—A matter involving a serious point for the Corporation came up before the Electric Lighting and Tramways Committee recently, when Mr. C. A. L. Prussmann, the borough electrical engineer, reported upon an application by Messrs. Gregor Bros., sawmill proprietors, for electrical energy for their works. The Corporation had submitted terms, and it transpired that the manager of the Swansea Harbour Trust afterwards intimated to Messrs. Gregor that if they were prepared to pay an all-round price of 1½d. per unit, the Harbour Trust might supply the energy from its docks' electricity station. These terms were below those of the Corporation, and Mr. Colwill, the vice-chairman of the Committee, declared that the sooner they faced the question whether the trustees intended to compete with the town electricity supply the better. During discussion it transpired that Messrs. Gregor's premises were on Corporation property, but that the Trust mains could be extended through a hole that might be made in the wall of the building. It was resolved to confer with the Corporation Harbour Trustees on the subject, and meanwhile to report to Messrs. Gregor that the Corporation offer still held good.

Warrington.—The borough treasurer reports that the income from the electricity undertaking for the year ended March 31st last was £16,818, and the expenditure was £9,231. After deducting payments of interest and instalments of loans, there was a net profit of £1,691, as against £943 in the previous year. The amount received from sales of current had increased by £671, chiefly owing to increased consumption and a better average price for power. The expenditure had decreased by £88, notwithstanding an increase of £282 on public lamps and the inclusion of £74 for transformers and £175 for meters. £938 of the balance to credit is to be placed in the reserve fund, which now amounts to £9,099. The capital expenditure was £98,269, of which there were loans outstanding of £79,755. The net profit from the tramway undertaking was £2,750, as against £2,370 in the preceding year. The receipts showed an increase of £540.

Wednesbury.—The Corporation has received the sanction of the L.G.B. to the borrowing for purposes of electric lighting of the sum of £2,858, made up as follows:—£1,300 in respect of mains, repayable in five years; £750 in respect of services, to be repaid in 15 years; and £808 in respect of meters, to be repaid in five years. The Electric Lighting Committee reports to the Council that the demand for electricity has grown to such an extent that it is necessary to substantially increase the plant to meet the next winter's load. In view of this, the Committee has visited works in various parts of the country and inspected different types of engines. It recommends that the works be extended by the purchase of a 230-KW. gas engine and dynamo, and that the contract for this be given to the British Westinghouse Co.; also that application be made to the L.G.B. for sanction to borrow £4,600 to cover the estimated cost of the extension.

West Bromwich.—The T.C. has decided to apply for a loan of £11,386 for extensions of the generating and distributing plant.

Yorkshire.—The Yorkshire Electric Power Co. has applied to the B. of T. for permission to use overhead lines for the transmission of energy at a pressure of 10,000 volts, from Dewsbury to Shawcross Colliery, thence to Stanley, Methley, Whitwood, Allerton Bywater, Castleford to Ledston Luck Colliery.

TRAMWAY and RAILWAY NOTES.

Bradford.—Mr. C. J. Spencer, manager of the tramways, has submitted his annual financial report on the working of the tramways. The total revenue for the year was £259,696, an increase of £15,462; the net profit was £32,345, which is more than double that of the preceding year. It was suggested that the sum of £20,000 be devoted to the relief of the rates.

Burnley.—The Tramways Department annual report shows the receipts to have been £2,856 more than in the previous year. The passengers carried numbered 12,911,113, an increase of 734,331; the car-miles run were 1,263,118, an increase of 33,894; the traffic receipts per car-mile were 12·41d., against 12·22d; the expenditure per car-mile was 7·89d., a decrease of ·10d.; the gross income was £65,525, an increase of £2,856. The net balance of £13,122 (against £11,093 in 1908) was disposed of as follows: Rent of leased portions of tramways, £2,057; income-tax on profits, £832; contingencies, £1,000; reserve fund, £6,000; and relief of the borough rate, £3,233. The reserve or renewals fund is £43,614.

China.—It is stated that an application has been filed on behalf of an American firm for a concession to build a system of overhead tramways in the city of Peking.

Colchester.—During the past year the North Station route was run at a profit of £375: the other routes were, however, worked at a loss, as follows: Lexden, £907; Hythe, £886; Eastgate, £585; and Recreation Ground, £528. The net deficit for the past financial year was £2,531, as compared with a deficit of £3,840 in 1908-9. The working expenses, 6·24d. per car-mile, including energy, were the lowest since the first year of working.

Continental Notes.—France.—La Société des Chemins de Fer Economiques du Nord is in negotiation with the authorities of the Pas de Calais Department with reference to the adoption of electric traction on 63 km. of its railways in the Valenciennes district.

The finishing touches are being put to a new 1,500-H.P. electric locomotive which the Société des Ateliers de Constructions Electriques du Nord et de l'Est, of Jeumont, are building for the Compagnie du Chemin de Fer du Midi.

Russia.—La Société des Tramways de Taschkend has commenced work on the conversion of its horse tramway to electrical traction, as also the construction of 21 km. of new electric tramway in the town of Taschkend.

Croydon.—The annual report and accounts of the tramway undertaking came before the B.C. on Monday. The traffic receipts for the year were £83,030, and other receipts £1,817. The working expenses were £63,083, while interest, repayments of loans, and income-tax, absorbed £15,666. A net balance of £7,006 was left after deduction of interest and sinking fund charges; this, as compared with the preceding year, was an increase of £3,711. Mr. T. B. Goodyer (general manager) states that this would have been larger but for continued motor-'bus competition, a large increase in mileage run, and a heavier rainfall. The average number of cars in use daily was 53, and 18,705,604 passengers were carried. During the year the link with the L.C.C. system was completed, and in eight months there were 757,761 through bookings, representing £9,356 in receipts, of which £3,039 was receivable by the Croydon tramways authority. Councillor Lighton thought the reserve of £24,137 was not what it should be if the track, as originally estimated, had to be relaid next year. Alderman Trumble remarked that experience showed that the estimated time was premature. The work would probably not be begun before the year after next. The report and accounts were unanimously adopted.

Flintshire.—A committee of local gentlemen is being formed with a view to procuring an order, under the Light Railways Act, for the construction of a light railway in Mid-Flintshire at a total estimated cost of about £200,000.

Glasgow.—Though the official figures have not yet been issued, some of the more interesting features of the working of the Corporation tramways for the 12 months are announced. Total traffic receipts for the year show an increase of £4,260 over those of the previous year. The total, £893,591, while not a record, is very satisfactory, all things considered. As in former years, the 1d. fare has proved to be the backbone of the system, the number of such tickets issued reaching the enormous figure of 132,929,172—considerably more than half the total number of passengers carried. In passengers too, the year has proved a most successful one, the total number carried, 222,730,571, being 986,002 in advance of that of last year. The average track mileage open during the year (single) was 188½ miles, an increase of 8 miles.

Keighley.—At the meeting of the T.C. on Tuesday, the chairman stated that the estimated income on the tramways for the past year was £8,400, and it had turned out to be £8,993, an increase of £593. The expenses had not varied materially. There was a balance of £3,525 to carry forward to net revenue, and with bank interest there was a gross profit of £3,655. From this had to be paid £2,908 for interest and sinking fund, leaving a net balance of £747. Allowing for a loss of £532 last year there was a profit of £215, which it was proposed to put to renewals fund.

Little Hulton.—The Little Hulton D.C. has re-opened negotiations with the South Lancashire Tramways Co. respecting the construction of tramways from Streetgate to Farnworth and Walkden connecting with the South Lancs. Co.'s system in those townships.

London.—A sum of £100 is to be spent by the L.C.C. in carrying out experiments with a view to obtaining information regarding rail corrugation. The cost of dealing with corrugation on the Council's system is £1,500 per annum, but the ultimate loss traced to this cause is estimated at £12,000 per annum.

Maidstone.—The Corporation has considered a proposal to extend the electric tramways of the borough to the neighbouring town of Chatham—a distance of nearly 7 miles. It is estimated that the carrying out of the scheme would involve an expenditure of £60,000, and that a yearly net profit of about £2,000 would be earned.

Malvern.—The Malvern Hills Conservators have decided, with regret, that they cannot give their official consent to the construction of a funicular railway on the hills in consequence of the legal difficulties, there being no provision in their Acts to enable them to do so. At the same time, they are not opposed to the principle of the scheme.

Manchester.—The Tramways Committee has just completed a new double loop line in Stevenson Square, which will be the terminus of the Oldham, Hollinwood, Bradford Road and Ashton *viâ* Droylsden cars, which have previously had a terminus in Piccadilly. The alteration will facilitate the running of through cars from Newton Heath to Alexandra Park, and from Clayton to Old Trafford.

Northampton.—Preliminary plans and estimates have been prepared for the extension of the tramways to Far Cotton, the estimated cost being £14,560, made up as follows:—Permanent way, £9,670; overhead equipment, £1,220; cables and feeders, £1,420; four cars, £2,250.

Nottingham.—The municipal tramways are to be extended along Carlton Road at an estimated cost of £14,000.

The annual report of the Tramways Committee shows that there is a credit balance, which is to be disposed of as follows:—To reserve and renewals fund, £1,748; transferred in aid of rates, £20,500.

St. Helens.—At the meeting of the T.C. on the 1st inst., it was stated that during the past year there had been £3,076 over-spent on tramway repairs. The Haydock section had cost about £3,000 to repair buckled rails and trouble caused by mining subsidences. Altogether they had to raise £5,796 extra for tramways.

Sheffield.—The tramway track in a portion of Attercliffe Road is to be re-laid at an estimated cost of £4,700. When this work is proceeding, the centre poles are to be taken out, and span wire construction erected in place thereof. Tenders are to be obtained for the supply of points and crossings at Shoreham Street depôt.

Ventnor.—The U.D.C. has passed a resolution to the effect that it is expedient that the Council should consider the means of reaching the different levels of the town with special reference to the construction of an electric tramway, and that any necessary action should be taken without delay.

TELEGRAPH and TELEPHONE NOTES.

Cable Compacts.—We have received from Mr. F. Ward, manager in England of the Commercial Cable Co., the following statement issued by Mr. George G. Ward, vice-president and general manager of the company:—"One or two London newspapers having questioned the correctness of the statement made by our president, Mr. Clarence H. Mackay, in which he denied the existence of any foundation whatever for the rumours of a combination between the Commercial Cable Co. and the Anglo-American Telegraph Co., I wish to emphatically and positively reiterate all our former statements that neither the Commercial Cable Co. nor the Postal Telegraph Cable Co., its landline connection in the United States, have ever contemplated, or now contemplate, any combination with the Western Union Telegraph Co., the Anglo-American Telegraph Co., or any other telegraph or cable company. The Commercial Cable Co. and the Postal Telegraph Co. are, and always have been, independent and purpose remaining so, thereby maintaining the trans-Atlantic telegraph competition which they originally introduced."

New Cable.—The cable between Ascension and Buenos Ayres was opened on Friday last. It is stated that this is the second longest in the world.

Wireless Telephony.—The *Daily Mail* of June 8th describes some experiments successfully carried out by Mr. A. J. Sharman on telephonic transmission through the earth, with a view to facilitating communication with miners in case of accident. The experiments took place at Chislehurst, where there are long

subterranean caves. One instrument was fixed on the surface, the telephone circuit being connected to two iron pegs driven into the ground, and the other was similarly fixed in the caves below. Conversation was carried on with ease, and telegraphic signals were also transmitted. Similar results have, of course, been obtained by earlier experimenters. As the depth was apparently not very great, it is doubtful whether equally successful results would be secured in an actual coal mine, where the intervening strata, moreover, would probably offer very considerable resistance to the current.

CONTRACTS OPEN and CLOSED.

OPEN.

Algeria.—*African Engineering* states that tenders are again invited for the building and working of an electric tramway between Oran and El-Ancor, Algeria.

Australia.—Brisbane.—June 22nd. Deputy Postmaster-General. Copper wire, insulators, battery material, &c. Local representation. Deposits may be paid at the High Commissioner's Office, 72, Victoria Street, S.W.

S. Australia.—July 6th. Cordless switchboards for the P.M.G.'s Department in South Australia. See "Official Notices" May 20th.

Victoria.—July 19th. 4,200 Commonwealth telephone sets, for the P.M.G.'s Department in Victoria. See "Official Notices" May 27th.

Melbourne.—June 17th. Arc lamp carbons, for the City Council. See "Official Notices" May 27th.

Melbourne.—July 1st. 36,000 incandescent lamps for the City Council. See "Official Notices" to-day.

Bargoed.—June 11th. Wiring and fitting for the electric light at the new police court. W. E. R. Allen, Deputy Clerk to the C.C., Westgate Street, Cardiff.

Barnes.—June 14th. Low-tension triple-concentric cable for the U.D.C. See "Official Notices" May 20th.

Batley.—June 28th. Battery of accumulators, automatic reversible traction booster, and one battery charging booster, for the Corporation. See "Official Notices" to-day.

Belfast.—June 13th. Electric lighting installations in the new asylum buildings on the Purdysburn Estate, for the Committee of Management of the Belfast District Asylum. Specifications 10s. (returnable), from Messrs. Watt, Tulloch & Fitzsimons, 77A, Victoria Street, Belfast.

June 22nd.—Direct-coupled steam engine and dynamo, for the Harbour Commissioners. See "Official Notices" to-day.

Bristol.—June 13th. Electrical plant and fittings for the refuse destructor, Eastville, for the T.C. T. H. Yabbicom, City Engineer, 63, Queen Square (returnable deposit of £2 2s.).

June 11th.—Electric lighting and other electrical work for the new Chemical and Physiological Buildings, at the University. Consulting Engineer, H. T. Sully, M.I.E.E., Scottish Widows' Buildings, Baldwin Street, Bristol. Specifications, two guineas, from the Registrar at the University.

Clacton-on-Sea.—June 22nd. 440 yds. armoured twin 7/18 vulcanised bitumen service cable, for the U.D.C. See "Official Notices" to-day.

Devonport.—June 15th. D.C. meters, paper-insulated cables, rubber-covered wires, cut-outs, and lubricating oils, for a year, for the Corporation. See "Official Notices" June 3rd.

France.—June 20th. The Sous-Directeur des Constructions Navales, at Toulon, is inviting tenders for the establishment of a central electricity generating station at Missiessy.

M. Modelski, Ingenieur-en-Chef des Ponts et Chaussées, at La Rochelle (Charente Inférieure) is inviting tenders for the contract for the electrification of the various plants connected with the dock gate opening gear at the port of Rochelle-Pallice.

German East Africa.—According to the *British and South African Export Gazette* a 30,000-H.P. plant is required in connection with the projected electric power installation at the Pangani Falls, German East Africa.

Ilford.—June 14th. 1,600 yds. of conduit for the U.D.C. electricity department. Particulars from Mr. A. H. Shaw, electrical engineer, at the Works.

Italy.—The Consultative Commission of the Municipal Electric Tramways, of Rome (49, Piazza S.S. Apostoli), is at present inviting tenders for the supply of 50,000 metres of three-phase electric cable (8,200-350 volts), 30,000 insulators, several alternators of various capacities, the necessary hydraulic turbines for the operation of the same, and 220 km. of copper wire, &c. Open to international competition. No date is given for tenders to be received.

Kingston-upon-Hull.—June 20th. Supplying and laying mains, for the Hull Corporation Electricity Committee. See "Official Notices" June 3rd.

Leeds.—June 21st. Installation of Osram lamps with transformers, at the Workhouse and Infirmary, for the B.G. J. H. Ford, clerk, South Parade.

Leith.—The Corporation invites tenders for the supply of 11,000 tons of coal for the Electricity Department. T. B. Laing, Town Clerk.

London.—L.C.C.—July 5th. 250 car bodies, 250 sets of centre bearing swing bolster trucks and 250 overhead and trolley equipments. See "Official Notices" to-day.

Manchester.—June 22nd. Meters, service cables, motors and motor-starters, for the Corporation. See "Official Notices" to-day.

Newport (Mon.).—June 27th. Low-tension, high-tension and extra-high-tension switchboards, for the Electricity Committee. See "Official Notices" to-day.

Portsmouth.—June 22nd. Alternative prices are invited for one and two years' supply of best Durham small and best North Country screened nut coal (10,000 to 12,000 tons per annum), for the Electricity Supply Committee.

Rawtenstall.—July 1st. Tramway permanent way construction, steel poles, overhead equipment, cables, conduits, trenching, section boxes and accessories, for the Corporation. See "Official Notices" to-day.

South Shields.—June 13th. Stores for the Corporation Tramways Department. See "Official Notices" May 27th.

Spain.—July 5th. La Febbrica Nacional at Trubia is inviting tenders until July 5th, for the supply of five 50-H.P. electric motors, two of 30 H.P. and eight of 20 H.P.

Stalybridge.—June 11th. Engine fuel and stores for a year, for the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board.

Stockport.—June 22nd. Materials for the Corporation electricity and tramway departments. R. Lomax, Tramways and Electrical Engineer, Millgate.

Sudan.—According to *African Engineering* tenders are invited by the Sudan Government Steamer Department for two 15-KW. electric lighting sets, driven by high-speed engines, a motor-generator, switchgear and motors.

Swansea.—June 27th. Twelve months' supply and delivery of motors and starting switches for the Corporation. See "Official Notices" June 3rd.

Turkey.—June 15th. The Turkish Ministry of Public Works in Constantinople is inviting tenders for the concession for the construction and working of a further section of electric tramways in the town of Salonika.

October 28th.—H.M. Consul at Constantinople (Mr. A. T. Waugh) reports that tenders are invited by the Turkish Ministry of Commerce and Public Works for a concession for the construction and working of electric tramways in the city of Constantinople and its suburbs. For further particulars see this column for June 3rd.

West Bromwich.—June 20th. Paper-insulated, lead-covered, feeder and pilot cables, for the Corporation Electricity Department. See "Official Notices" June 3rd.

West Ham.—June 20th. Electric light installation at three schools, for the Education Committee. See "Official Notices" May 27th.

CLOSED.

Belfast.—The tenders of Messrs. J. H. Holmes & Co., Newcastle-on-Tyne, for the supply of a motor booster and switchgear, and Messrs. Cowans, Ltd., Salford, for switchboard extensions respectively, have been accepted.

Blackpool.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for high-tension switchgear for the new sub-station at South Shore.

Bootle.—The T.C. has accepted the tender of the Chloride Electrical Storage Co., Ltd., for repairs and renewals to the accumulators, and that of Messrs. Yates & Thom, Ltd., of Blackburn, for repairs to two boilers, at £210.

Burnley.—The Tramways Committee has ordered two single-decked cars at a cost of £753 13s. 6d. each. The following tenders have been accepted:—The United Electric Car Co., two car bodies, at £292 each, and the British Thomson-Houston Co., electrical equipment, at £264 per car, with the following materials (per car):—Trucks, £115; sundry accessories, £16; tools, £6; track brakes, £31; run-back preventer, £17; lifeguards, £9; and side route indicators, £3.

Burton-on-Trent.—The T.C. has accepted the tender of the Brush Co., for a synchronous motor-generator, at £257.

Calcutta.—The Port Commissioners have accepted the tender of the Russa Engineering Works, Ltd., amounting to Rs. 8,838 for the supply and erection of three electrically-driven pumps at the Kidderpore Docks.—*Indian and Eastern Engineer.*

Colchester.—The T.C. has accepted the tender of Messrs. Veritys, Ltd., for six disconnecting pillars, at £16 10s. each; and that of Messrs. W. T. Henley's Telegraph Works Co., for cable, at £37.

Derby.—The T.C. has accepted the following tenders:—Electric Construction Co., Ltd., switchboard extension, £303, and motor-generator, £683; Messrs. W. Rickard, Ltd., bitumen cable, £1,721 10s.; Chloride Electrical Storage Co., Ltd., replating lighting battery, £100 upon completion of the work, and six other annual payments of £93; also maintenance of battery for 12 years for £70 per annum.

Glasgow.—The Tramways Committee recommends the following for acceptance:—

Dry cells.—Wm. M'Geoch & Co., Ltd.
Telephone pillars.—David King & Sons.
Rubber.—George M'Lellan & Co.

Heckmondwike.—The U.D.C. has accepted the tender of Messrs. Deane & Beale for condensing plant, at £2,418.

Italy.—La Société des Ateliers de Constructions Electriques de Charleroi (Belgium), has submitted the lowest tenders to the Consulting Committee of the Municipal Tramways in Rome for the supply and installation of three sets of transformers, two substations and a travelling crane.

Leyton.—The U.D.C. has accepted the following tenders:—

Reason Manufacturing Co.—Annual supply of electrolytic ordinary meters.
Mordey, Fricker & Co.—Annual supply of electrolytic slot meters.

London.—L.C.C.—The Stores and Contracts Committee has accepted the tender of the Ruberoid Co., Ltd., for electric insulating materials. The following tenders have been received for car bodies and equipments:—

(*a*) 39 *double-deck car-bodies, with roof covers.*

Hurst, Nelson & Co., Ltd.	(accepted)	£14,040
Brush Electrical Engineering Co., Ltd.		14,469
United Electric Car Co., Ltd.		14,742
Metropolitan Amalgamated Railway Carriage and Wagon Co., Ltd.		15,366

(*b*) 39 *sets of electrical equipments.*

British Westinghouse Electric Co., Ltd. ..	(accepted)	12,753
Dick, Kerr & Co. Ltd.		13,006
British Thomson-Houston Co., Ltd.		13,045

(*c*) 40 *centre-bearing four-wheeled bolster trucks.*

United Electric Car Co., Ltd.		4,880
Hurst, Nelson & Co., Ltd.	(accepted)	4,980
Metropolitan Amalgamated Railway Carriage and Wagon Co., Ltd.		5,040

The Highways Committee reports that it has in the cases of (*a*) and (*b*) accepted the lowest tenders submitted, namely, that of Hurst, Nelson & Co. (£14,040) for the car bodies, and that of the British Westinghouse Co. (£12,753) for the electrical equipments.

In the case of (*c*) it has accepted the second lowest tender (Hurst, Nelson & Co.) (£4,980) as that firm offered the earliest time for delivery (9 weeks as compared with 15 weeks, the time proposed by the firm submitting the lowest tender), which is a matter of considerable importance.

It has also accepted an offer, amounting to £2,280, of the British Westinghouse Co. to manufacture, supply and deliver 40 sets of magnetic track and wheel brake equipments for double-deck cars.

Battersea.—The B.C. Lighting Committee recommends the acceptance of the tender of the Albion Clay Co., for conduits required for mains extensions, &c., in the Nine Elms and other districts.

Marylebone.—In addition to the list published in our last issue of successful tenderers for annual supplies for the B.C., we understand that the tender of Messrs. Feld Bros. & Co., Ltd, for cut-outs, has also been accepted.

Metropolitan Water Board.—The Board has accepted the following tenders:—

Appleby Crane and Transporter Co., Ltd.—Provision and erection of a motor-generator (to be manufactured by the General Electric Co.) for coal transporter apparatus, £105.
Rees Roturbo Manufacturing Co.—Centrifugal pump and electric motor for Ealing, £55 10s.

Morecambe.—The T.C. has accepted the tender of Messrs. Edmondson Bros., of Morecambe, for a cooling tower for the electricity works.

Newport (I.W.).—The Isle of Wight Joint Isolation Hospital Board has accepted the tender of the Isle of Wight Electric Light Co. for installing the electric light at the new hospital at Fairlee, at £113 12s.

Plymouth.—The Electricity Committee has decided to accept the tender of Cory Bros., the present contractors, for the supply of 7,500 tons of coal, at 13s. 4½d. per ton.

Sheffield.—The T.C. has accepted the tender of the Electric Supply Department, at £45, for a 10-H.P. motor and wiring at the baths.

Tunbridge Wells.—The T.C., on June 1st, accepted the following tenders:—

Underfeed Stoker Co.—Mechanical stoker, £199.
Fuller Manufacturing Co.—Motor, £28.
Burnand & Co.—Transformer, £3 10s.
Ross, Hotchkiss & Co.—Circulator, £60.

Wednesbury.—The T.C. has accepted the tender of the British Westinghouse Co. for a 230-KW. gas engine and dynamo.

Wolverhampton.—The District Electric Co., Ltd., of Wolverhampton and Birmingham, have received instructions to carry out the electric lighting installation at St. Luke's Church, Blakenhall, Wolverhampton. The firm has sent us a long list of public installations which they have recently carried out.

Wrexham.—The T.C. has accepted the tender of the British Economical Lamp Co., for the supply and renewal of metallic-filament lamps, at 7s. 6d. per pillar per annum for the first year and 5s. per annum afterwards.

FORTHCOMING EVENTS.

Physical Society.—Friday, June 10th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "A Galvanometer for Alternate Current Circuits," by Messrs. W. E. Sumpner and W. C. S. Phillips; "The Positive Electrification due to Heating Aluminium Phosphate," by Mr. A. E. Garrett.

North of England Institute of Mining and Mechanical Engineers.—Saturday, June 11th. At 2 p.m. At the Wood Memorial Hall, Newcastle-on-Tyne. Papers open for discussion: "The Electrification of Murton Colliery, Co. Durham," by Mr. E. S. Wood; and "Electricity at the Shamrock I and II Colliery, Herne, Westphalia," by Mr. H. M. Hudspeth. Demonstration at Armstrong College of the ignition of coal-dust by single electric flashes, and discussion on paper on same subject by Prof. W. M. Thornton and Mr. E. Bowden.

Municipal Electrical Association.—The Fifteenth Annual Convention will be held at Glasgow and Edinburgh, June 14th to 17th. Particulars were given in our issues of May 27th and April 8th.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are announced:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, June 13th.—"A" Company. Recruits' infantry drill, 6 to 6.45 p.m.; technical drill, 7 to 9.30 p.m.
Tuesday, June 14th.—"B" Company. Recruits' infantry drill, 6 to 6.45 p.m. technical drill, 7 to 9.30 p.m.
Wednesday, June 15th.—Gymnasium, 6 to 9.30 p.m.
Thursday, June 16th.—"C" Company. Recruits' infantry drill, 6 to 6.45 p.m.; technical drill, 7 to 9.30 p.m.
Friday, June 17th.—"D" Company. Technical drill, 6.30 to 9.30 p.m.

(Signed) P. H. Campbell, Capt. R.E., Adjutant.
For O.C. E.E., L.D.

Electric Cabs in Berlin.—According to the directors of the electric cab undertaking carried on in Berlin under the title of the Elektromobil-Droschken Gesellschaft, there has probably never been a board pursued by so much misfortune as that of this particular company. They state that notwithstanding the realisation of economies through the extension of the repairing shops and in various other ways, it was not possible to equalise the falling off in the receipts. The embargo placed upon cab numbers, which was referred to in the report for 1908, had rendered itself felt in quite a different way to what had been hoped. The chief of police, in connection with the prohibition relating to benzine motor cabs, had sanctioned the acceptance within a specified time of the cabs already ordered, and the result was an acceleration of the construction by the makers and the placing in service of an enormous number of new cabs within a short time. The sudden increase accentuated competition with the then existing cabs, and a large number of the company's drivers transferred their services to other cabs, owing to the promise of higher wages, there soon resulting a shortage of drivers in Berlin in consequence of the numerous vehicles. The company's accounts show a loss of £16,000 for 1909, and the deficit thereby is advanced to £28,700 on a share capital of £150,000. Although business has improved in the present year, it is pointed out that the number of motor cabs in Berlin is still considerably too large, the company alone having 205 cabs and 26 other vehicles.

THE "GASING" OF THREAD BY ELECTRICITY.

One of the last operations in the manufacture of cotton and woollen threads is "gasing"—the process of burning off the ends of fibres, &c., which stand up above the surface, leaving the latter smooth and flawless; it is so called because it is generally effected by passing the material rapidly through a gas flame. In *La Technique Moderne* an article was recently published describing the progress which had been made in substituting electricity for gas in the performance of this operation, by M. L. Bargeron. The author remarks upon the inappropriateness of the title in this connection, and proposes to employ instead the term "electrage"; to our mind neither term is so apt as the more significant word "singeing."

The operation is naturally one which closely affects the health of the employés, who are exposed to the products of combustion of both the gas flames and the particles of cotton or wool, unless exceptional precautions are taken to remove them. Moreover, the efficiency is extremely low, more than 96 per cent. of the heat energy being wasted, and the variability of the flames detracts from the regularity of the result.

In the apparatus described by the author, a platinum tube, or rather trough, *a*, fig. 1, is employed with a bore as small as possible, so as to utilise the heat to the best advantage. The length of the trough depends upon the counts of the thread operated on. The trough is split open at each end, and the lugs *l l'* thus formed are beaten out to form short tongues at the top end, which are gripped between copper jaws *b*, while at the lower end they are made into long and flexible strips which convey the current without hindering the expansion of the trough. A number of such elements are mounted together upon compressed asbestos, forming a bank, and are connected with the electric circuit by spring contacts. A section of the trough is shown at S.

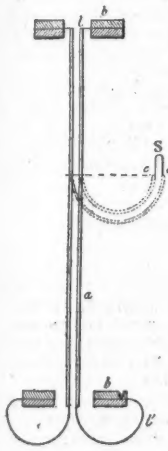


Fig. 1.

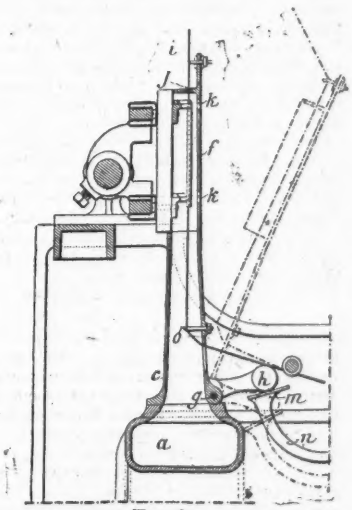


Fig. 2.

The thread to be singed is carried over a pivoted frame of box section, *c*, fig. 2, the lower end of which opens into an air-duct *a* by which the products of combustion of the fibres are carried away; the frame is provided with guides *o*, *i* which lead the thread through the trough without touching the sides, and a cover *f* which shields the operator from the radiation of the tube. Thus when the apparatus is in operation, the "burner" is almost completely enclosed; it may be inspected through small holes *k k* at the top and bottom, and the opening *j* at the top through which the thread passes also allows sufficient air to enter to burn off the fibres. The box is pivoted at the foot *g*, and when drawn back by a counter-weight *h* stops the thread, which is then exposed to view. A treadle *m n* controls the position of the box.

The burner must be of considerable length in order to accomplish the desired object while the thread is passing through it at a high speed. The French authorities have adopted a speed of 400 m. per minute, and experiments have been carried out which show that at this speed a burner 100 mm. long gives the best all-round results, the temperature being cherry-red and the power expended 40 to 50 watts per burner. Various alloys of platinum with rhodium and vanadium, &c., have been tried for the burners, and have proved very satisfactory with animal fibres, but the silica in cotton tends to form a silicide of platinum, leading to breakage of the burners. This difficulty will, no doubt, be overcome.

It is claimed that a considerable economy can be effected by the use of electrical singeing as compared with gas, besides greater uniformity in the quality of the threads.

Inquiry.—A correspondent wishes to obtain the name of maker of an electromagnetic clutch capable of transmitting 600 H.P. at 45 R.P.M.

NOTES.

Copper.—The *Financier* of May 28th, quoting from the *Wall Street Journal*, reports a general reawakening of interest in the copper market. The fact that certain consumers are willing to purchase from the United Metals Selling Co. at 13 cents a lb. is taken as an indication that many of the large agencies and producers who have been selling copper at a lower figure are sold up pretty well into the future. Stocks during April (this will refer to U.S.) increased 8,100 tons. Since the first of the year 208,399 tons of copper have been produced, and 208,297 tons delivered, making stocks as on May 1st approximately the same as those on January 1st last. Since January 1st the visible supply for the world has increased by about 2,677 tons. Production does not show signs of the long-expected curtailment. In April 3·9 million lb. were turned out per day, as compared with 3·87 in March. In English statistics this is 1,748 tons per day, which does not seem quite up to former annual production. Large as the movement into consumption now is, says the article, the demand is nothing abnormal, but is the natural outgrowth of a long period of low-priced copper.

The export from the United States is low, as Europe is supplying from stock. It is not very easy to see, from the above report, why the price of copper should harden.

The shrinkage in stocks shown by Messrs. Merton's circular for May 31st remains moderate. The visible supplies now stand at 106,815 tons, as against 110,207 tons for the end of April. The reduction of 3,392 tons is traceable to stocks in English ports, and a drop in the quantity afloat from Chile. French stocks are only down 31 tons, but, of course, the total held there, 6,211 tons, is small. Supplies from North America are naturally low to this country, but remain about average to the Continent. From Spain and Portugal England takes little more than half the average, other countries taking 6,158 tons, the highest quantity since last August. Chile and Australian shipments for May are about average.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The annual report of the Council for the Session 1909-10 shows that the total membership increased during the year from 6,097 to 6,222. During the Session, 15 general meetings, two special general meetings, and 19 Council meetings have been held, while there have also been held 45 meetings of local sections.

The Council has made the following Scholarship and premium awards:—Salomons Scholarship, value £50, to B. C. Clayton, King's College; David Hughes Scholarships, valued £50 each, to G. W. P. Page, Central Technical College, and A. D. Peacock, University College.

The Institution Premium, value £25, to Mr. Miles Walker for his two papers "Short Circuiting of Large Electrical Generators and the Resulting Forces on Armature Windings," and the Design of Turbo Field Magnets for Alternate-Current Generators, with Special Reference to Large Units at High Speeds."

The Paris Electrical Exhibition Premium, value £10, to Prof. A. Schwartz, for his paper, "The Testing of Rubber for Electrical Work."

The Fahie Premium, value £10, to Mr. S. G. Brown, for his paper, "A Telephone Relay."

A Premium, value £10, to Messrs. W. P. Digby and D. B. Mellis, for their paper, "Some Properties of Switch and Transformer Oils;" and a Premium of similar value to Mr. G. W. Worrall, for his paper, "Commutation Phenomena and Magnetic Oscillations occurring in Direct-Current Machines."

Premiums, valued £5 each, to Messrs. F. Hope-Jones, F. H. R. Lavender, Albert Campbell, C. F. Smith and L. W. Wild.

Students' Premiums have been awarded for papers by Messrs. R. C. Plowman, £10; A. P. Young, £5; P. J. Cottle and J. A. Rutherford, £5; P. Kemp and W. A. Stephens, £5; and W. H. Young, £5.

Amongst other matters mentioned in the report, committees have been appointed to consider the question of an examination for associate membership, the articles of association, and electricity in textile mills; the Council has during the session taken action in connection with the Electric Lighting Act, 1909, and the Home Office rules for the use of electricity in mines. The capital account of the benevolent fund stood at £3,500 on December 31st, 1909, as compared with £3,000 at the end of 1908; grants in aid amounting to £77 were made during 1909. The Wilde Benevolent Trust fund amounts to £1,745, and one grant of £25 was made from it during 1909.

Professional Conduct.—The Council has decided to adopt the regulations recently incorporated in the by-laws of the Institution of Civil Engineers, and subject to the proposal receiving sanction, these will be embodied in the articles of association and be applicable to members of all classes. The Regulations are as follows:—

Every member of the Institution shall observe and be bound by the following regulations:—

1. He shall act in all professional matters strictly in a fiduciary manner with regard to any clients whom he may advise, and his charges to such clients shall constitute his only remuneration in connection with such work, except as provided by Clause 4.

2. He shall not accept any trade commissions, discounts, allowances, or any indirect profit in connection with any work which he is engaged to design or to superintend, or with any professional business which may be entrusted to him.

3. He shall not, while acting in a professional capacity, be at the same time, without disclosing the fact in writing to his clients, a director or member of, or a shareholder in, or act as agent for,

any contracting or manufacturing company or firm or business with which he may have occasion to deal on behalf of his clients, or have any financial interest in such a business.

4. He shall not receive, directly or indirectly, any royalty, gratuity, or commission on any patented or protected article or process used on work which he is carrying out for his clients, unless and until the receipt of such royalty, gratuity or commission has been authorised in writing by those clients.

5. He shall not improperly solicit professional work, either directly or by an agent, nor shall he pay, by commission or otherwise, any person who may introduce clients to him.

6. He shall not be the medium of payments made on his clients' behalf to any contractor or business firm (unless specially so requested by his clients), but shall only issue certificates or recommendations for payment by his clients.

Any alleged breach of these regulations or any alleged professional misconduct by a corporate member which may be brought before the Council, properly vouched for and supported by sufficient evidence, shall be investigated, and if proved shall be dealt with by the Council either by expulsion of the offender from the Institution or in such other manner as the Council may think fit.

The Institution Building.—It is expected that the offices will shortly be transferred to the building, and that the lecture theatre, library and members' rooms will be ready for the opening of the new session.

The British Electrotechnical Committee, 1910.—This consists of the Council for the time being of the Institution, with the addition of Mr. K. Edgcumbe, Mr. S. Z. de Ferranti, Mr. H. W. Miller, The Lord Rayleigh, O.M., F.R.S., Capt. H. R. Sankey, Mr. C. P. Sparks, Mr. A. P. Trotter and Mr. E. B. Vignoles.

An informal meeting of the Electrotechnical Committees of the various countries will take place in Brussels next August.

The wiring rules and model general conditions for contracts are under revision.

The Society of Engineers (Inc.).—On Friday last, on the invitation of Mr. A. L. C. Fell, chief officer of the London County Council tramways, a number of members and their friends visited the central car repair depôt at Charlton.

On June 6th a paper on "The Inspection and Testing of Engineering Materials and Machinery," was read by Mr. C. V. Biggs, A.I.E.E. The author treated of the tests usually applied to the various machines and materials which go to the formation of an electrical generating station, and commented on the difficulty of issuing a comprehensive specification which should exactly define the requirements for all the details needful in any large engineering undertaking, as well as the tests necessary to ascertain that these conditions were fulfilled. While noting the excellence of material presented for tests by the leading English manufacturers, the author does not anticipate that these tests can be to any large extent dispensed with, in view of the variations from time to time brought to light by this practice.

Institute of Marine Engineers.—On Saturday, June 25th, this Institute will hold a meeting in the Congress Hall of the Japan-British Exhibition. The Hon. William Hall-Jones, High Commissioner for New Zealand, is to preside, and a number of papers will be read, including one by Mr. W. R. Commins on "Internal Combustion Engines for Marine Use," and another by Mr. T. J. Kean, B.Sc., on "Experimental Study of an Oil Engine."

Institution of Municipal Engineers.—At a meeting of the Council on May 25th, Mr. A. Ernest Prescott, borough engineer and surveyor of Eastbourne, was unanimously nominated as President of the Institution for the year 1910-11.

Incorporated Association of Municipal and County Engineers.—The Lancashire and Cheshire District meeting of the Association was held at Barrow-in-Furness on Saturday, when the members had the opportunity of seeing the Corporation undertakings, Messrs. Vickers, Sons & Maxim's Naval Construction and Engineering Works, the Kellner Partington Paper Pulp Works, Steel Works, &c. Alderman Smith, J.P., chairman of the Electricity Committee, conducted visitors through the Corporation Electricity Works and to the Walney Bridge, where electrical power is used for lifting the leaves of the bridge designed by the late Sir Benjamin Baker.

Metropolitan Association of Electric Tramways Managers.—A meeting of this Association was held on Friday, 3rd inst., at the offices of the Metropolitan Electric Tramways, Ltd., Manor House, Finsbury Park, London, N. Those attending were:—Mr. H. E. Blain (West Ham), acting chairman; Mr. Schofield (Leyton); Mr. Mittelhausen (Bexley); Mr. Ullmann (East Ham); Mr. Murray (Walthamstow); Mr. Goodyer (Croydon), hon. secretary; Mr. A. H. Stanley (managing director, London United Tramways, Ltd.); Mr. Hammond (Metropolitan Electric Tramways, Ltd.); Mr. A. V. Mason (South Metropolitan Tramways); and Mr. W. Binns (Reading), was also present by invitation. The hon. secretary reported that he had received further communications from America respecting the registration of accident claims; that, on request, he had supplied a schedule of the Through-running Arrangements in the Metropolitan Area to the Public Service Commission, Fourth District, New York, U.S.A., and, further, that he had been invited to join, as representing the Association, a Committee formed for the Protection of Electrical Interests. Mr. Blain then explained the views of the hon. secretary, and himself, as to the preliminary course which should be adopted in connection with the proposed Central Bureau for the Registration of Claims, and the proposition was agreed to. The company then left by special car (kindly provided by the Metropolitan Electric Tramways, Ltd.), for a visit of inspection to the car repair works at Hendon. They were shown over the shops by Mr. J. Devonshire, the managing director of the company, and Mr. A. H. Pott, the chief engineer, and were greatly interested in the various appliances and arrangements which they inspected. Mr. Pott demonstrated the methods used in the company's motormen's training school. Subsequently, the members returned to London, and were entertained to dinner by Mr. Stanley.

Dinner.—The first annual dinner of the L.C.C. Tramways electrical staff (Greenwich, north and south sub-stations), was held on Wednesday, June 1st, at the Horse Shoe Hotel, Tottenham Court Road, W., Mr. J. H. Rider, M.I.E.E., presiding, supported by Mr. J. Shepherd, Mr. E. L. Pope, Mr. T. L. Horn and Mr. Walker. About 70 members of the staff were present. After the loyal toast an excellent musical programme entirely provided by the staff, was carried out. The toast, "Our Chairman," was proposed by Mr. C. S. Wright, and drunk with musical honours. Later in the evening the chairman responded; in the course of an interesting speech he advised his hearers that the only way to attain success in the electrical profession was to keep steadily plodding, and, furthermore, to seize the opportunity when it presented itself. He also impressed on the company the necessity of debating electrical problems amongst themselves, and urged as many as could to join the Institution of Electrical Engineers, concluding by stating that the success of the L.C.C. tramways was due in a great measure to the efficient way in which the electrical staff carried out their duties. Mr. Walker proposed "The Committee," and Mr. A. L. Johnson responded. The Committee consisted of Messrs. F. Scott, C. S. Wright, H. Storey, C. A. Butcher and A. L. Johnson, hon. sec.

The "Merry Devil's" Reception at Preston.—"Onlooker," who wrote about the "Merry Devil" in our "Correspondence" columns last week, would doubtless have had considerable satisfaction had he been present at the Prince's Theatre, Preston, on Tuesday night, when Bodie was subjected to heckling and interruption from a large body of electrical students and workers. According to the reports, there might have been nothing more than heckling and continued uproar, had not some pushing about on the staircase brought a policeman to grief. This resulted in a general fight between the interrupters and the police, and the proceedings became warmer, when an arrest was made. Seven young men were taken to the police station, but they were liberated on bail. The following morning they appeared at the Borough Police Court on a charge of assaulting the police, and of riotous and disorderly conduct. One of them was fined 10s. and costs for the assault and 10s. for damage to the policeman's uniform. The remainder of the charges were withdrawn on the promise that there would be no repetition of the offences.

Lightning.—The past week has been marked by several severe electrical storms in the south of England, accompanied by heavy rains. At Shipton-on-Stour, according to the *Daily Telegraph*, a flash of lightning cut the telephone wire leading to a doctor's house and ruined the instrument. The wires at the post office were fused, and the switchboard was blown out and set on fire, whilst the postmaster, who was in the exchange room, received a violent shock. All the electric bells in the town were set ringing. Houses in various parts of London were struck, and a girl was killed. Several people received shocks. At Wallingford the trolley wires were struck, and the tramway service was disorganised. Firemen were kept busy by false alarms. At Old Windsor the electricity supply cables were damaged, and insulators broken.

Appointments Vacant.—Tramways overhead wireman, for the Bolton Corporation; instrument maker and assistant lecturer in electric wiring, for the Salford Royal Technical Institute, (£100); junior shift engineer (30s.), and premium pupil, for the Wednesbury Electricity Department; assistant mechanical and electrical engineer for the Middlesex County Asylum, Napsbury, near St. Albans (35s. and cottage); junior mains assistant for Leith (35s); assistant electrical engineer for Watford (£120). For further particulars see our advertisement pages in this issue.

Messrs. Ed. Lloyd, Ltd.—We mentioned last week that the energy consumed in producing a single issue of *Lloyd's Weekly* was about 3,500 units; it should be understood that this includes the energy used by the whole of the auxiliary machinery, as well as by the presses.

Electric Light Convention.—The annual Convention of the National Electric Light Association was held at St. Louis, U.S.A., last month: over 3,000 members were present, out of a total membership of 5,523.

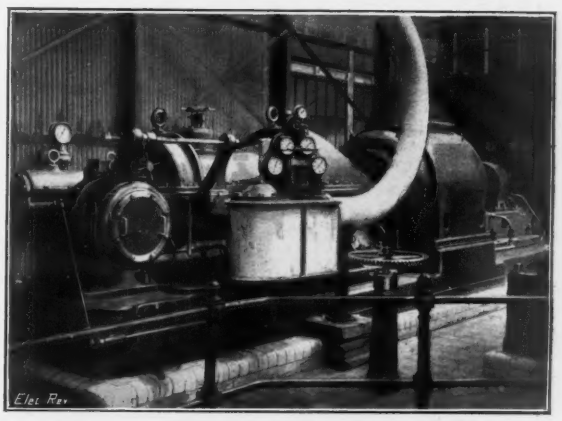
International Electro-Technical Commission.—The annual report of the Commission has just been issued to the members of the various committees. There will be no official meeting of the Commission this year, but the Belgian Committee has issued an invitation to the other committees to an informal meeting at the Brussels Exhibition in August. The next official meeting will be held at Berlin next year.

(*Continued on page* 961.)

THE GREENOCK ELECTRICITY UNDERTAKING.

The Burgh of Greenock is a seaport town of 73,000 inhabitants situated near the entrance to the River Clyde, its chief industries, in addition to shipping, being shipbuilding and sugar refining.

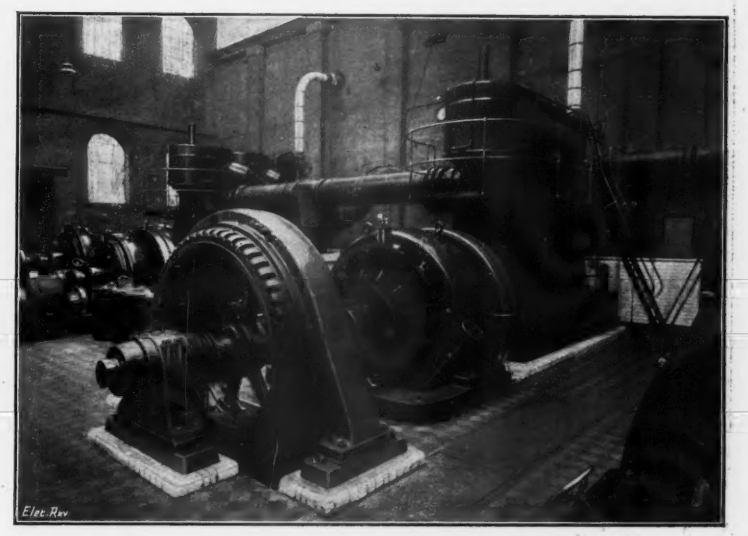
The municipal electrical undertaking, which commenced operations just 10½ years ago, has been referred to in the Review on many occasions, and a description of the original works at Hunter Place, appeared in our issue of August 3rd, 1906. At that period the output of the undertaking was 1,840,000 units per annum, but so rapid has been the increase in the power demand in the district that the energy sold for the current year exceeds 5 million units. As the original works at Hunter Place were incapable of being extended to cope with this large increase, new works have been erected at Dellingburn Street, and it is these the present article is intended to describe.



1,000-K.V.A. Westinghouse-Parsons Turbo-Alternator.

While the question of extension was occupying the attention of the Electricity Committee, another Committee was dealing with the disposal of town's refuse, and as it was found impossible to continue the system of depositing the refuse at a tip, the Corporation decided, after much discussion, to combine the new generating station with a refuse destructor on a site at Dellingburn, which would provide ample space for all future extensions.

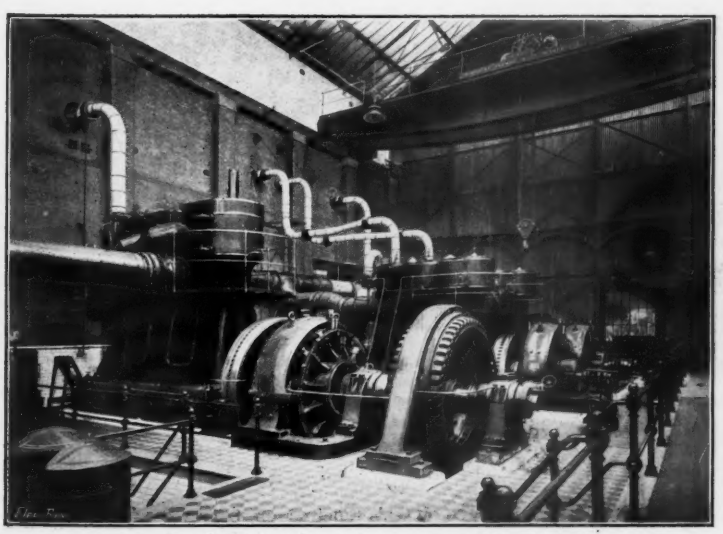
The site, in some respects, is an ideal one, being fairly central and provided with a railway siding, while an ample supply of water for condensing purposes is available.



Interior of Engine Room showing 750 kw. Belliss-Westinghouse Sets.

The destructor plant has been described elsewhere (Electrical Review, May 8th, 1908), and need only be referred to briefly. It consists of six destructor furnaces, or cells, of the "Horsfall" type constructed as three units of two cells each; each unit is worked in conjunction with a Babcock & Wilcox marine boiler. The outstanding feature is the system of charging the cells, known as "tub feed," by which all manual labour is dispensed with. The refuse is delivered from the carts into tubs placed in a tipping pit, and these are afterwards raised by an electric crane to a platform above the furnaces. In charging a cell the tub is deposited by the crane on a charging cradle directly over the opening, and by a system of balanced levers the door in the furnace crown is lifted from its water-seal and slides clear of the opening, while the bottom of the tub, which is formed of two hinged flaps, opens with the weight of the charge, and the refuse is deposited in the furnace. The whole operation of charging, including the opening and closing of the furnace door, occupies less than one minute.

The strongest claim made for this system of charging is its cleanliness as compared with systems of hand-feeding, but the results of working show that for steaming results it will compare favourably with any other type, and during the first year's working 67½ units have been generated per ton of refuse destroyed, while the sum paid by the Electricity Department for steam was sufficient to cover all the working expenses of the destructor, including wages and repairs.



750-kw Double Current Generator and 400-kw. Belliss-Westinghouse Sets, Dellingburn Works.

F

View of the Main Switchboard, Dellingburn Works.

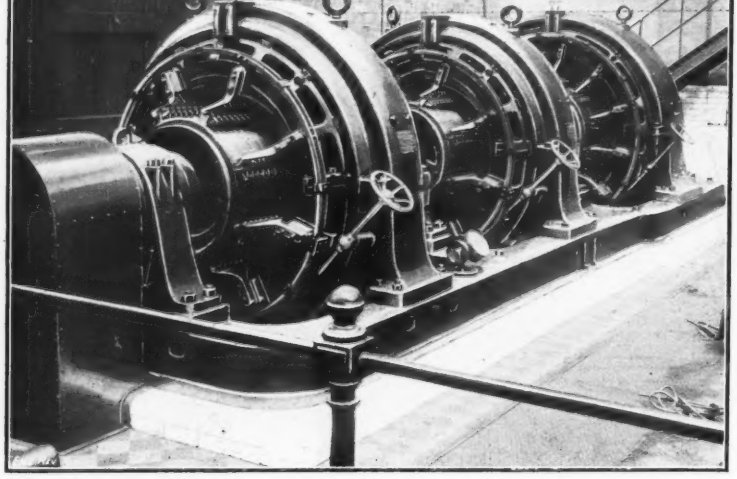
The combined works consist of four bays, the largest forming the engine room at the east side of the building. The bay at the extreme west houses the destructor plant, while the two centre bays form the combined boiler house, the destructor boilers already referred to, being on one side, while the other is occupied by three Babcock & Wilcox coal-fired boilers; each of these boilers is capable of evaporating 16,000 lb. of water per hour. By arranging the buildings in this manner, the dust arising from the destructor is kept as far away as possible from the engine room, while the position of the boilers in the central bays minimises the length of steam piping and facilitates easy supervision of both sets of boilers.

The steam piping is arranged on the unit system, one 10-in. main being carried along the boiler house, with a branch to each engine and boiler taken off at intervals. Isolating valves are provided with extended spindles, all the steam valves being of the Ferranti-Hopkinson type. In the pump house two electrically-driven Worthington pumps are installed and two steam-driven Weir pumps. A head pump is also provided to pump water up to an oil-extracting plant on the upper floor, which also supports a storage tank of 12,000 gallons capacity.

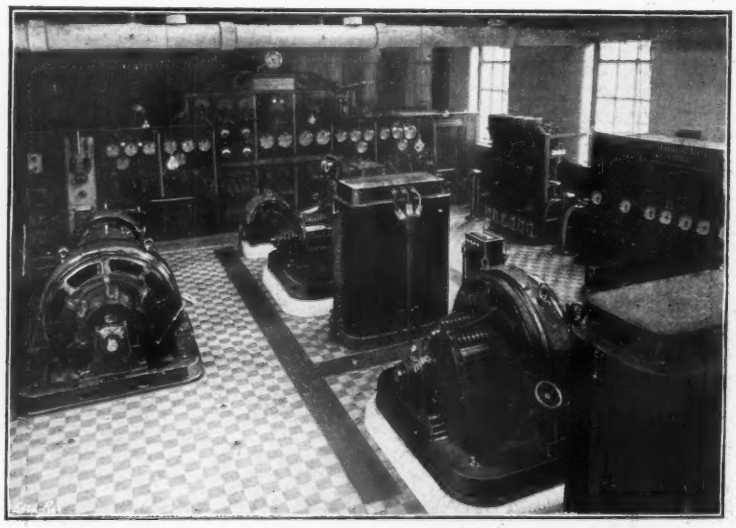
Until recently the supply at Greenock has been L.T. direct current at 500 and 250 volts. Provision has been made for L.T. generation in the new station, but more recently the requirements of the power load have led to the adoption of a H.T. three-phase system, which is used at present to supply energy to one large power user, and to an outlying district for lighting. The pressure of supply is 3,300 volts at 50 periods.

An important customer has been obtained in the new torpedo factory now being erected at Fort Matilda, and the supply, which is to commence from July 1st, is estimated at 400 KW. The length of H.T. feeder to this factory is 4,800 yards, and the Admiralty sub-station will transform down to 220 volts, three-phase, for power and lighting.

The direct-current plant in the engine room consists of two 750-KW. Belliss-Westinghouse generators of standard type, one of these sets being arranged as a balancer with two dynamos, each working at 250 volts. A large motor-generator, with interchangeable armatures, is used as a link between traction and lighting, and also as a motor-balancer on the three-wire system. The second large engine drives a 500-volt D.C. generator, and there has recently been coupled up to the same shaft an alternator, supplying three-phase current at 3,300 volts pressure. The set is thus a double-current generator, and is intended to be run during the night and at week-ends, when the load on each supply can be economically taken by one engine. In addition to the large sets there are two 400-KW. Belliss-Westinghouse sets which have been removed from the Hunter Place works.



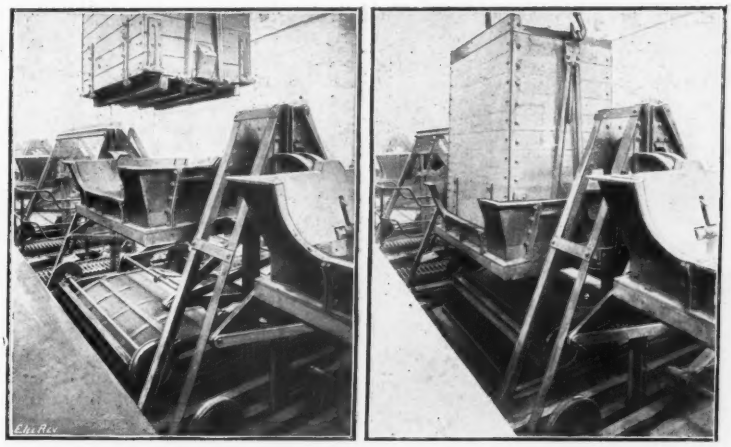
750-KW. Motor-Generator for Traction or Lighting Supply.



Interior of Messrs. Scott & Co.'s Sub-Station, Supplied in Bulk at 3,000 Volts, Showing 500-KW. Rotary Converters, Transformers, Switchgear, &c.

These sets are of the makers' standard design, and of quite recent construction.

The condensing facilities at the works are probably unique in this country, inasmuch as the cooling water is obtained from the town's aqueduct by gravitation. This water is really the overflow from the town's reservoirs, and the aqueduct which was originally laid to meet the requirements of the sugar refineries, follows a course through the site of the new works to the sea. The total available head is about 23 ft., so that no difficulty is experienced in obtaining an ample flow through the condensers. The supply is partially shut off between 9 p.m. and 6 a.m. and also at week ends, but during the day it is estimated that the supply is sufficient for three times the existing capacity of the works, viz., 15,000 KW.



Tub being lowered. Tub in position; furnace door opening.

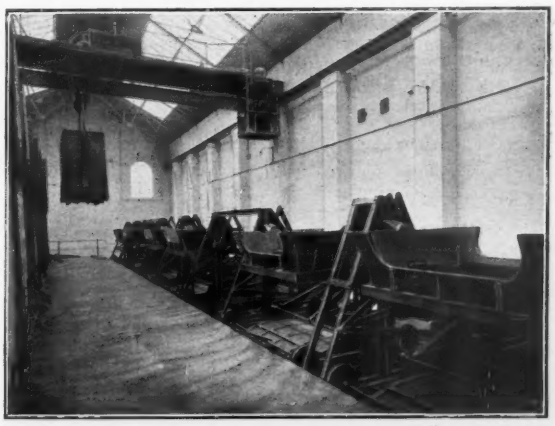
HORSFALL DESTRUCTOR, DELLINGBURN WORKS: SHOWING THE TUB FEED.

The condensers are of the surface type, each pair of reciprocating engines being coupled to one condenser. There is also a main exhaust pipe which couples the condensers together so that they can be run in parallel if required, or one condenser can be used in an emergency for either or all of the four engines. The air pumps are of the well-known Edwards type.

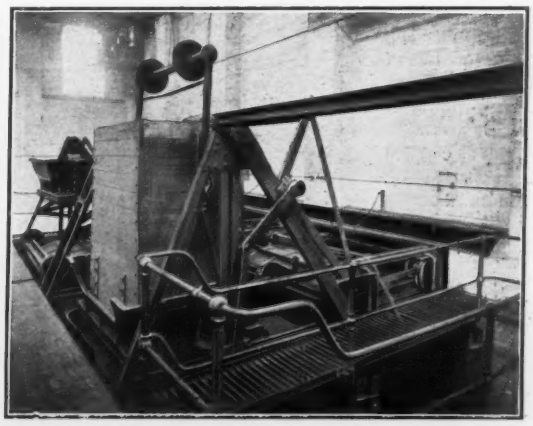
The D.C. switchboard is of massive design and was supplied by the Westinghouse Co. The panels are of black enamelled slate, the switches and instruments being nearly all interchangeable. The bus-bars are mounted above the board leaving a clear passage at the back with easy access to all connections.

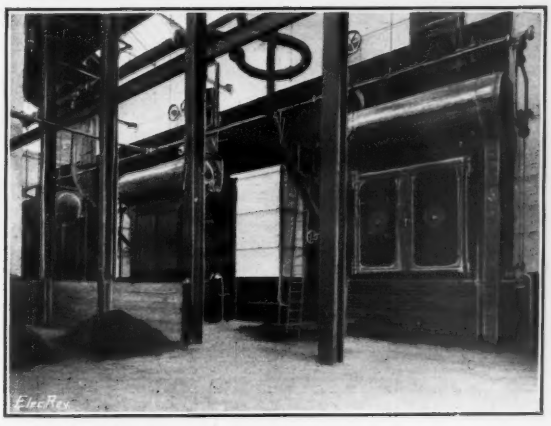
The H.T. plant consists, in addition to the engine alternator already referred to, of one 1,000-K.V.A. turbo-alternator of the Parsons - Westinghouse type, which embodies the latest improvements in design and construction. The speed of 3,000 R.P.M. appears at first sight to be somewhat high, but when it is remembered that the choice to obtain a given periodicity must lie between 1,500 R.P.M. and the higher speed, and that apart from a difference in first cost of 20 per cent., the difference in efficiency, as quoted by the leading makers, was from 12 to 15 per cent., there appears to be good reason for the selection. This set was guaranteed to carry its rated load,

STORAGE PLATFORM, SHOWING TOP GEAR OF DESTRUCTOR CELLS.

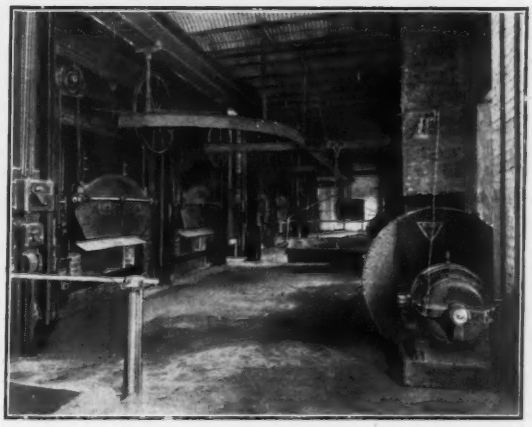


CHARGING CELL FROM TUB.





THE DESTRUCTOR BOILERS.



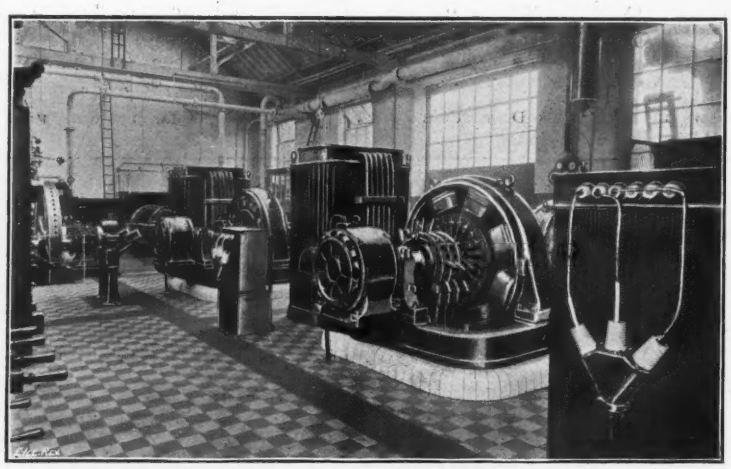
CLINKERING FLOOR, SHOWING DRAUGHT FANS AND CLINKER RUNWAY.

with steam at 190 lb. pressure per square inch superheated to 480° F., with 16½ lb. of steam per KW. and a condenser vacuum of 28 in. A by-pass is provided which enables an overload of 25 per cent. to be taken continuously. The set is fitted with a powerful centrifugal governor, and the usual

emergency governor for operation in case of accident. The turbine is neatly lagged with planished steel, and the whole of the casing and parts are of high-class finish throughout.

Dellingburn Works: Coal Fired Boilers.

The turbine condensing plant is situated in a pit in the basement, and is of the usual surface type with 30,000 sq. ft. of cooling surface. The air pump is of the Le Blanc rotary type, direct coupled to an electric motor. A separate extractor pump, driven by chain gear from the motor spindle, is provided to draw away the water from the condenser and deliver it to a tank in the pump room which serves as a hot-well and measuring tank. The simplicity of the Le Blanc pump is its outstanding advantage, as there are no buckets or reciprocating parts to get out of order. The circulating water tank used with this pump is placed under the floor and a priming pipe is connected to the circulating water system. The whole arrangement strikes one as being extremely simple and compact, and it should compare very favourably on the score of reliability with any kind of reciprocating pump. The condenser exhaust is also connected to the main exhaust pipe, so that, in case of emergency, the turbine can be run exhausting into either or both of the other two condensers.

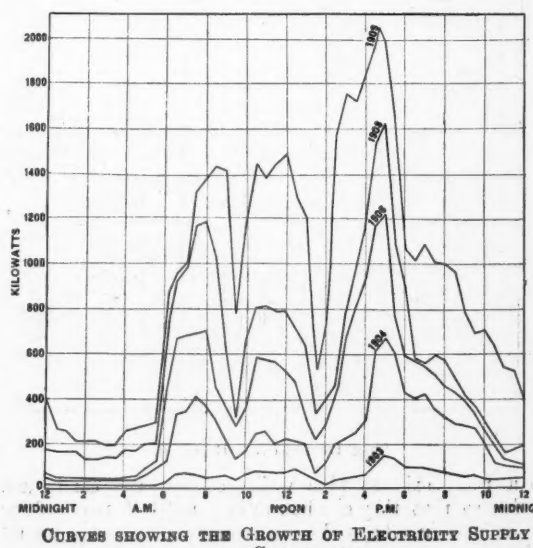


Transformers and Rotaries, Messrs. Scott's Sub-station.

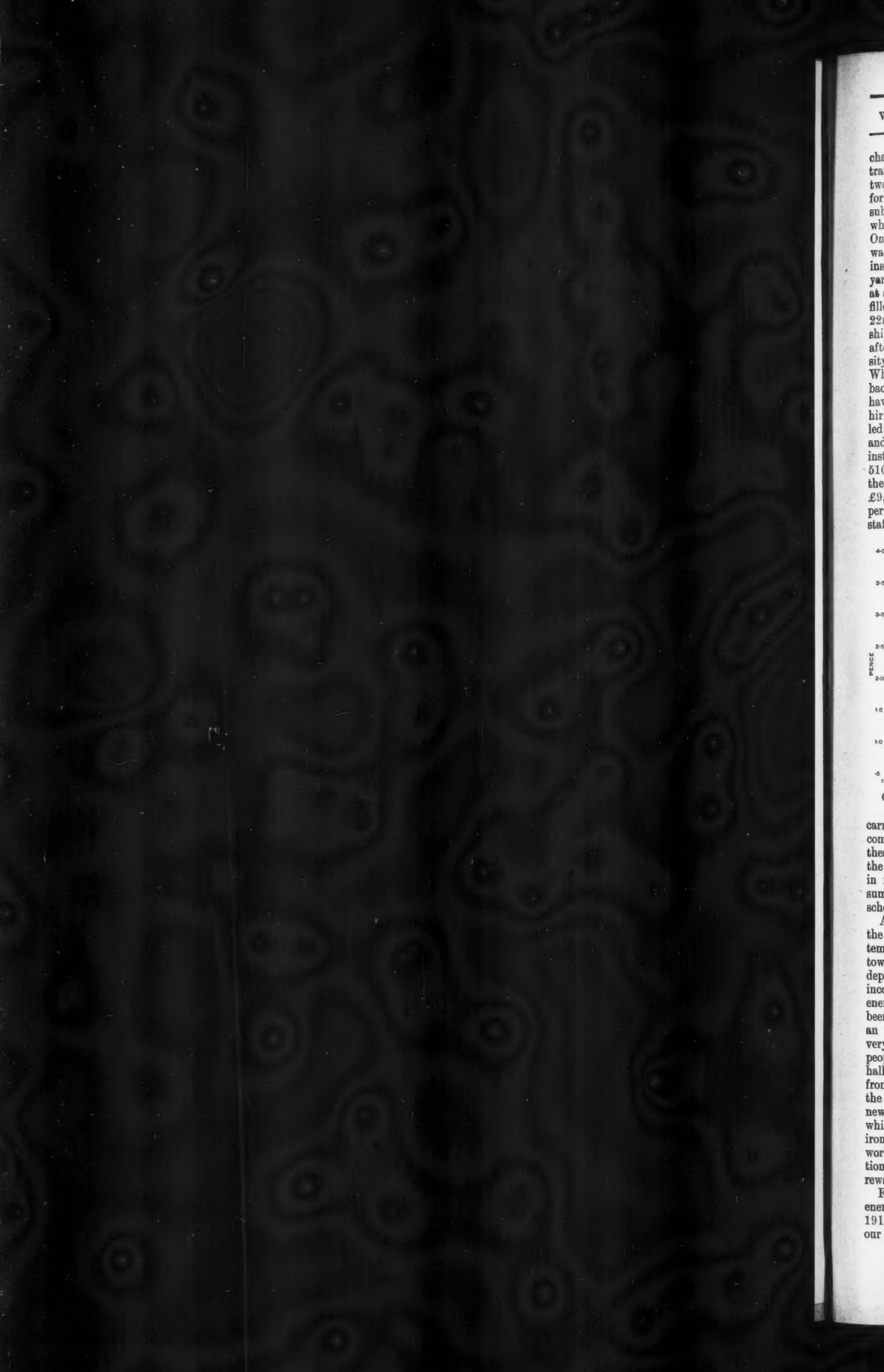
The turbo-generator is of the revolving cylindrical-field type, of very solid construction, the field winding consisting of massive copper bars held and clamped in semi-closed slots. The field is compounded as described in the paper recently read by Mr. Miles Walker, the regulation being designed so that the rise in pressure up to full load at unity power factor compensates for the drop in turbine speed and the voltage drop in the line. On the lower power factors the regulation is much better than with the ordinary A.C. generator. The collector rings are of the radial type, and the exciter is direct coupled, its commutator also being of the radial type. In practice, this design of commutator runs very smoothly and overcomes entirely the difficulties due to jumping of the brushes and the consequent sparking which occurs on high-speed commutators built in the ordinary way. It may be said that while the guaranteed steam consumption was 16·5 lb. at full load, the actual consumption on full load test averaged 15·9 lb.

The H.T. switchgear is of the remote-control type, operated mechanically by means of cranks and levers. The switches are of the oil-immersed pattern, and are placed in brick cubicles on a special platform over the main gallery which carries the operating panels. Provision is made for four feeders, two generators and two rotaries. The whole of the switchgear was supplied by the British Westinghouse Co.

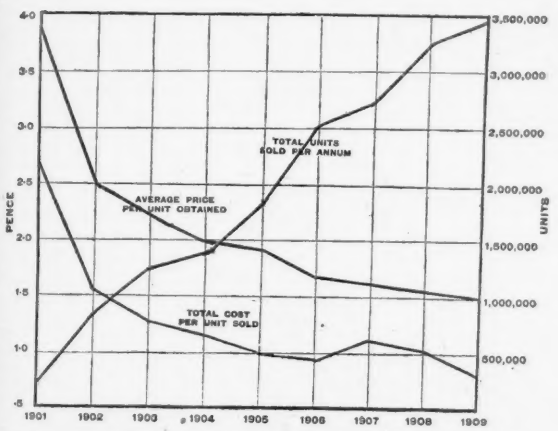
The largest power user in the district is Messrs. Scott's Shipbuilding and Engineering Co., Ltd., who formerly had a private generating plant. We give views of the sub-station in Messrs. Scott's shipyard, where three rotary converters and transformers of a total capacity of 1,100 KW. at 240 volts, direct current, have been installed by the Corporation. These machines are compound wound, and are of specially strong construction with large commutator surface. They are guaranteed to take a 25 per cent. overload for two hours, and 50 per cent. overload for 15 minutes without sparking. The combined transformer and rotary efficiency at full load is 92 per cent., and at half load 89 per cent. The field compounding is designed so that the voltage automatically rises from 220 volts at no load to 240 volts at full load. A synchronous motor is provided with each of the two larger rotaries for starting, but the smaller set can be started by a



Curves showing the Growth of Electricity Supply in Greenock.



change-over switch connected to tappings from the transformer. The high-tension switchboard comprises two feeder panels, one starting panel and three transformer panels all of the self-contained cubicle type. This sub-station building formerly housed five steam generators, which have been superseded by the Corporation supply. One condition of this firm's contract with the Corporation was that the engines should be removed and the rotaries installed without interruption to the operation of the shipyard and engine works, and although the change was made at a particularly busy time, this condition was strictly fulfilled, the first rotary being set in operation on January 22nd. As the firm were engaged in building the battleship *Colossus*, which was launched in April last after a new time record for construction, the necessity for this condition will be easily understood. While the supply to large power users is undoubtedly the backbone of the Greenock business, the small consumers have not been neglected. A "free wiring" and motor-hiring scheme has been in operation for six years, and has led to an extended adoption of electricity by shopkeepers, and by many householders. There are at present 230 such installations in use, and 75 motors, having an aggregate of 510 H.P., have been supplied on hire and hire-purchase; the amount of capital invested in the business is nearly £9,000, which yields an average net return of 9½ per cent. per annum in rentals. The department retains a wiring staff of its own, and most of the installations have been



CURVES SHOWING OUTPUT, PRICE AND COST PER UNIT, &c.

carried out by its own workmen, but it has refrained from competition with local contractors, and as far as possible these have been encouraged to work in co-operation with the department in securing new business. It is proposed in future that contractors introducing "free wired" consumers shall obtain the work of fitting up their premises at schedule rates to be mutually agreed on.

As in other towns, the output for lighting has suffered by the inroads of the metal-filament lamp, and although the temporary set-back is less felt in Greenock than in many towns on account of the large output for power purposes, the department has realised the necessity of increasing the income from existing services by encouraging the use of energy for heating, cooking, &c. Very little advertising has been done till lately, but in September last an exhibition on an extensive scale was held in the Town Hall and proved very popular. Care was taken to get the right sort of people to visit the exhibition during the afternoons as the hall was crowded every evening, hundreds being turned from the doors. Although a somewhat costly advertisement the result has justified the experiment, and the number of new consumers secured is greater than for any similar period, while a start has been made with the use of radiators, flat-irons and cookers. It may be added that the local contractors worked loyally with the Corporation in making the exhibition a success, and they have, no doubt, been duly rewarded.

For comparison the following table shows the sales of energy for all purposes for the 12 months ending May 31st, 1910, and the corresponding figures four years ago, when our last article appeared :—

	1905-6.	1909-10.
Private lighting ...	518,354	632,957
Public lighting	73,070	76,425
Power	878,597	3,709,584
Traction...	1,061,091	701,308
Total	2,531,112	5,120,274

A uniform rate of 4d. per unit is charged for energy used for lighting, but consumers are offered the option of the "maximum demand" system at 4d. per unit for 700 hours' use per annum of their maximum demand and 1½d. per unit for all in excess of this amount. The power rates are based on a sliding scale of from 2½d. to 1d. per unit or an alternative charge of 3d. per unit for 360 hours per annum of the consumer's maximum power and 1d. per unit thereafter. To increase the output for heating and cooking during the day and reduce the cost of wiring for mixed supplies, a "standing charge" system has lately been introduced, whereby a consumer pays a fixed annual charge based on his *lighting* demand, all energy, whether for lighting, heating or cooking, being charged for at 1d. per unit as registered on the meter.

Negotiations are in progress with the adjoining burgh of Port-Glasgow, under which it is proposed that the Greenock undertaking will provide a public supply system. As there are several large shipyards besides other power users to be obtained, the output from the Greenock works is likely to increase at a still greater rate during the next few years, and the question of a further extension to Dellingburn Works is already engaging the attention of the Corporation.

The undertaking during the past seven years has been under the charge of Mr. J. A. Robertson, M.I.E.E., who has been responsible for the design and erection of the new works described in the foregoing article. We are indebted to him for the information contained in the article, and also to a member of his staff, Mr. J. H. Parker, for the views with which it is illustrated.

THE CALCULATION OF ILLUMINATION.

BY C. TOONE.

IT is frequently desirable to determine rapidly the maximum and minimum illuminations due to a luminous source of known characteristics arranged in a stated manner; also, to determine roughly the mean illumination effected over a given area. The only satisfactory method of *accurately* obtaining this information is to make experimental measurements under the conditions presumed. Such measurements are tedious and difficult to make, and may be satisfactorily replaced in many instances by the following methods of calculation. In order to realise the limitations of the latter and to be able to allow for the same, it is necessary to state definitely the assumptions on which the results are based.

(*a*) The illumination due to a single luminous source is considered.

(*b*) This source is assumed to have a uniform polar curve of distribution.

(*c*) Extraneous illumination by direct or diffused reflection from mirrors or walls, &c., is supposed to be absent.

(*d*) The illumination effected is considered to be that on a plane surface—the floor or ground surface, or an imaginary plane, say, 4 ft. above the latter (for reading purposes, &c.).

Conditions (*b*) and (*c*) seldom obtain in practice. In cases where condition (*b*) is not complied with, the illumination at the required points, due to a source of 1 C.P. placed at the same spot and under the same conditions as the actual source, may be calculated. Let this be I^1 candle-feet. Then from a polar C.P. curve of the actual lamp, the candle-power of the latter in the direction of each of the points concerned is at once ascertained. Multiplying the figure I^1 by these several candle-powers, the actual illuminations at the points considered are obtained (always assuming condition (*c*) to be fulfilled). By calculating the illuminations at a number of points in the area allocated to the source in question, a curve of illumination can be

take

plotted, to a base of horizontal distances. By measuring the area beneath this curve, by planimeter or otherwise, and dividing by the base length, the mean ordinate, and so the mean illumination over the area lighted, is ascertained.

Condition (*c*) is *very* seldom conformed to in practice and, unfortunately, it is all but impossible to allow for departure from it by calculation. All that can be done, in the ordinary way, is to calculate the maximum, minimum and mean illuminations as below, then proceeding as follows :— If the walls be very distant or be black or very dark red in colour, the departure from the calculated results will not be great. According to the nearness of the walls and the lightness of their hue, it may only be necessary to increase the calculated mean illumination by 10-20 per cent. on this account. The effect of the ceiling and floor (if the latter be bare, or covered with a light-coloured material) is much more important. If all the surfaces of the enclosure are very light in colour (but *matt* so as to obviate *direct* reflection), the illumination effected will be roughly the same as would be produced by a lamp of C.P. = mean spherical C.P. of the actual lamp, similarly disposed and having a uniform polar distribution curve. Intermediate cases can only be dealt with by using the subjoined methods of calculation, and increasing the results thereof by a factor determinable from the well-known data concerning the reflecting power of various wall materials, woods, &c., together with the judgment acquired only by experience. In the deriving of general results it is impossible to allow for departures from assumption (*c*).

In most practical schemes, and almost certainly in those cases where condition (*c*) is fulfilled, more than one luminous source affects the area particularly allocated to a given lamp. Here, again, no general assumptions can be made, but by determining the illumination curve of each of the lamps separately and then compounding these diagrams, when properly displaced with regard to one another, the resultant illumination curve at once follows.

The methods employed below for determining the maximum and minimum illuminations in given cases under the above conditions are quite general, but the formula for the mean illumination strictly applies only to circular areas. For practical purposes, however, it may be safely assumed to hold for square or other rectilinear figures approximating to a circular form. If an area such as a long, narrow rectangle has to be illuminated, the formula (No. 3) no longer applies, and the simplest procedure is to calculate the candle-feet illumination at such a number of points as will allow of the graphical determination of the mean illumination across a number of parallel lines in the surface lighted, these being, say, perpendicular to the longer side of the area. The mean of these averages is readily obtained by the graphical procedure already outlined, the result being the desired mean illumination over the whole area.

Bearing in mind the above explicitly-stated assumptions, the following results will be easily intelligible :—

1. *Maximum illumination*, due to a uniformly distributing source, of candle-power K, placed d feet above the illuminated plane, is—

$$I_{max} = K/d^2 \text{ candle-feet} \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

by a fundamental law of illumination, the lighting being here normal, since maximum illumination is obtained vertically below the source, and no question of reflection is involved.

2. *Minimum illumination*, due to the same source, similarly placed. Let the point most remote from the source in the illuminated area be at a horizontal distance p from the foot of the vertical through the source ; let the angle θ have the meaning shown in fig. 1, so that $\tan\theta = d/p$; then the illumination on a plane perpendicular to S M is—

$$I_p = K/(p^2 + d^2) \text{ candle-feet.}$$

$$\therefore \text{ the illumination on the horizontal plane O M}$$

$$= I_p \sin\theta = K \sin\theta/(p^2 + d^2) = I_{min},$$

$$\text{but } \sin\theta = d/\sqrt{p^2 + d^2},$$

$$\therefore I_{min} = K\,d/(p^2 + d^2)^{\frac{3}{2}} = K.\ \sin^3\theta/d^2 \text{ candle-feet}, \ \ldots \quad (2)$$

which expression, in general, gives the illumination (candle-feet) at a point in the illuminated plane, distant p feet horizontally from the source (of K C.P.), suspended d feet above the plane considered.

3. *Mean illumination* due to the same source as before' similarly suspended ; the source is assumed suspended above the centre of a circular area of r feet radius. Applying formula (2), the illumination at any point in this area, p feet from the centre vertical, is—

$$I_p = \left(\frac{K}{d^2}.\sin^3\theta\right) \text{ candle-feet} =$$

$$\frac{K}{d^2}\cdot\frac{d^3}{(d^2 + p^2)^{\frac{3}{2}}} = \frac{K}{d^2}\cdot\frac{1}{(1 + p^2/d^2)^{\frac{3}{2}}}.$$

Therefore the area beneath the illumination curve, from the centre to the circumference of the area lighted (see figs. 2 and 3), is—

$$A = \frac{K}{d^2}\int_o^r \frac{1}{(1 + p^2/d^2)^{\frac{3}{2}}}.\,dp.$$

Let $\tan\alpha = p/d$, then $dp = d.\sec^2\alpha.\,d\alpha$, and $\sec^2 d = (1 + p^2/d^2)$, and when $p = o$, $\alpha = o$: $p = r$, $\alpha = \tan^{-1} p/d$,

$$\therefore \int_o^r \frac{dp}{(1 + p^2/d^2)^{\frac{3}{2}}} = \int_o^{\tan^{-1} r/d} \frac{d.\sec^2\alpha.\,d\alpha}{\sec^3\alpha},$$

$$= \int_o^{\tan^{-1} r/d} d.\cos\alpha.\,d\alpha = d\left[\sin\alpha\right]_o^{\tan^{-1} r/d},$$

$$= dr/\sqrt{r^2 + d^2}.$$

$$\therefore A = \frac{K}{d^2}\cdot\frac{d.r}{(r^2 + d^2)^{\frac{1}{2}}} = \frac{K\,r}{d\,(r^2 + d^2)^{\frac{1}{2}}},$$

and base line of $A = r$ feet,

$$\therefore \text{ mean ordinate—}i.e.\text{, mean illumination,}$$

$$= I_{mean} = \frac{K}{d\,(r^2 + d^2)^{\frac{1}{2}}} \text{ candle-feet} \quad \ldots \quad \ldots \quad (3)$$

which result, applying as it does only to sources having a uniform polar curve of C.P. and illuminating circular areas (if the area be approximately circular, the radius of the equivalent circle should be determined and procedure then made as above), may be expressed in words :—

The mean illumination in candle-feet equals the quotient of the candle-power of the source by the product (height of suspension in feet × square root of length (feet) of longest ray)* ... ... (4)

This mean illumination may be realised, if desirable for any reason, by placing a photometer screen, at any other

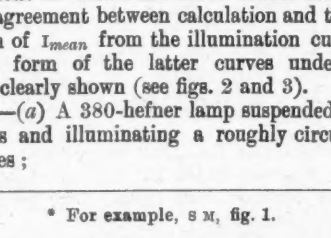


FIG. 1.

plane to be illuminated, at a distance H from the source such that—

$$H^2 = d\,(r^2 + d^2)^{\frac{1}{2}}$$

$$i.e.,\ H = \sqrt[4]{d^2\,(r^2 + d^2)} \text{ feet} \quad \ldots \quad \ldots \quad (5)$$

Examples of use of above formulæ.—Equations (1) and (2) need no illustration or verification by trial, but it may be well to demonstrate the correctness of equation (3) by selecting, at random, two particular examples (subject always to the conditions on which the above results are based), and showing the agreement between calculation and the graphical determination of I_{mean} from the illumination curves. Incidentally, the form of the latter curves under the given conditions is clearly shown (see figs. 2 and 3).

Examples.—(*a*) A 380-hefner lamp suspended at a height of 3·6 metres and illuminating a roughly circular area of 34½ sq. metres ;

* For example, S M, fig. 1.

(*b*) A 770-hefner lamp at a height of 6·8 metres, illuminating a circular area of 280 sq. metres.

Taking 1 hefner = 0·915 English C.P.,
1 foot = 0·3048 metre,
and 1 sq. ft. = 0·09291 sq. metre,

it will be seen that in *Case* (*a*) C.P. = 350, *d* = 12 ft., *r* = 10·93 ft. } approx.;

hence from equation (3)—

$$I_{mean} = \frac{350}{12\sqrt{119{\cdot}8 + 144}} = 1{\cdot}80 \text{ candle-feet};$$

while, by the use of equation (2) the data of Table I follow, whence is plotted the curve of fig. 2. The area below this

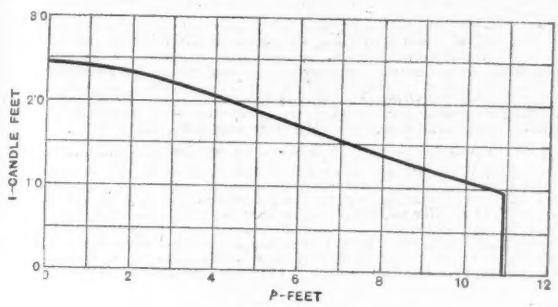


FIG. 2.

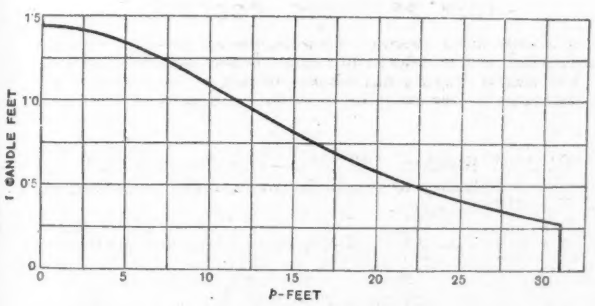


FIG. 3.

curve = 975 $\frac{1}{10}$ in. squares, and the base length = 5·46 in., hence mean ordinate = 1·785 in., which here corresponds to—

$$I_{mean} = 1{\cdot}785 \text{ candle-feet},$$

an excellent agreement with the above calculated result.

Case (*b*).—C.P. = 700, *d* = 22 ft., *r* = 31·08 ft. } approx.,

hence, from equation (3),

$$I_{mean} = \frac{700}{22\sqrt{968 + 484}} = 0{\cdot}84 \text{ candle-foot}.$$

TABLE I.

p (*feet*).	$(p^2 + d^2)^{\frac{3}{2}}$.	*Illumination* (*candle-feet*).
0	1,728	2·43 ($=I_{max}$)
2	1,801	2·33
4	2,023	2·075
7	2 681	1·57
10·93	4,289	0·98 ($=I_{min}$)

TABLE II.

p (*feet*).	$(p^2 + d^2)^{\frac{3}{2}}$.	*Illumination* (*candle-feet*).
0	10,640	1·445 ($=I_{max}$)
5	11 480	1·340
10	14,110	1·093
15	18,880	0·818
20	26,290	0·586
25	36 920	0·418
31·08	55,340	0·279 ($=I_{min}$)

By using equation (2), Table II has been calculated, and from it is plotted the curve of fig. 3.

Beneath the latter (as originally drawn) was an area of 1,038 $\frac{1}{10}$ in. squares; the base line = 6·2 in.,

∴ the mean height = 1·672 in., which corresponds to—

I_{mean} = 0·836 candle-foot, again in excellent agreement with the results of calculation.

Obviously, equation (3) eliminates the necessity for much tedious calculation and measurement of areas, and no apology is felt to be necessary for the present notes developing this formula, explaining the limitations to which calculated results concerning illumination are subjected, the conditions under which calculation is permissible, and the relative importance of departure from each of these stipulations.

NOTES.

(*Concluded from page* 954.)

WHY NOT?

(*Dedicated to Consulting Engineers.*)

If I could build machines of hay
And oyster-shells and glue,
Conductors wrought of common clay,
And bearings of bamboo;

If they would pass their tests and give
Performance superfine,
And never need repairs, but live
Till 1999;

Why need I be the slave of specs.
Full three-score pages long
And join the band that bow their necks
Beneath the rule of wrong?

Why do you say my iron must be
Just point nought one six through,
From hysteresis losses free
Annealed and varnished too?

Why do you think I need be told
My coils must be Cu?
If I prefer to give you gold
Why not? What's biting you?

In short, why not demand machines
To do the work in hand,
And let me choose the fittest means
To meet with your demand?

If I get good efficiencies
From dynamos of dough,
Not more than thirty-five degrees
Of Centigrade or so,

And they will run and run and run
Till Aconcagua rot
And Earth's consulting work is done,
I prithee, Sirs, WHY NOT?

MUDRETZ.

New Steam Turbine.—According to *Affärsvärlden* Mr. B. Ljungström, who for the past four years has been at work on a new steam turbine, has succeeded in developing a design which has only one-fourth of the size and weight of other turbines of the same output, thus effecting an important saving in freight and import duty. A turbine of 750 H.P. of Mr. Ljungström's design is said to have given a thermodynamic efficiency of 64 per cent., corresponding to a saving of 10 per cent. in steam and coal, as well as in boiler capacity, in comparison with other types. To exploit the invention the Ljungström Steam Turbine Co., Ltd., has been formed with a capital of 1,050,000 kr., and is supported by many prominent men in Sweden.

Submarine Signals.—THE SUBMARINE SIGNAL CO., of Friars House, New Broad Street, E.C., write with reference to our note of May 27th on the bell recently fixed off the Lizard, pointing out a rather important mistake. In the note it is mentioned that the bell was purchased from an American company. While it is true that the head office of the company's business is in Boston, U.S.A., they inform us that all work done on this side is done by the London office, and all material supplied is manufactured in Liverpool by their own British workmen. The supply of American-made apparatus would probably endanger their British patents, and for this reason the error in question should be corrected. The company are at present supplying four sets of bell apparatus for Trinity House for use on the Sunk, Breaksea, Cross Sand, and Morecambe Bay Lightships, these bringing the total of the Trinity House light vessels equipped with their bell apparatus to 16.

Electrical Fatalities.—An inquest was held on the 1st inst. into the death of Harry Colburn (23), Church Road, Altofts, who was killed whilst working at Newland Collieries, Normanton, on the previous Monday.

Lewis Wadsworth, of Sharlston, said that he was chargeman. Colburn, Reid and Bennett were in a place 3 ft. high with the electrically-worked coal-cutting machine known as the "iron man." The place was 4 ft. 6 in. wide, and on the ground, fastened at one end to the machine, and at the other to a prop, was a steel haulage rope, which, owing to a curve in the face, was not straight. There was, however, 2 ft. 6 in. standing room between the rope and the opposite side of the narrowest part. When all was ready witness sent Bennett to switch on the current. Witness was 10 yards from the machine, deceased a yard nearer. Suddenly Colburn, who had his left foot on the haulage rope, fell unconscious, and, he believed, dead. Witness attempted to pull the man away, but deceased was so charged with electricity that witness, after experiencing one severe shock, was afraid of his own life. Just then Mr. Gill, the collieries' manager, arrived, and, after the current had been switched off, he and another man, with Dr. Stewart, tried for over an hour to bring back life, but without avail. Witness placed his foot on the haulage rope, but only felt a slight shock.

Replying to questions by Mr. Poole, His Majesty's Inspector of Mines, witness said that, as required of a chargeman, he had seen all clear before switching on. He thought Colburn had inadvertently put his foot on the rope, as the place was very wet. There was plenty of light. He was carrying his lamp on his neck. The water that was rising might have got into the machine from beneath, and caused a leakage, which, running through the haulage rope, had caused Colburn's death. Colburn was wearing leather boots, and witness clogs. This would account for Wadsworth's escape, as the wood would act as an insulator.

George Armitage, milk dealer, Altofts, asked permission to give evidence. Colburn, he said, whom he had known 18 months as a cricketer, had told him he did not like the job, as he had sustained several shocks in the feet by electricity from the earth.

The Coroner: You acted very properly in proffering evidence.

Arthur Stones, Normanton, electrician, said he had examined the place referred to, and found the water had risen several inches, which had probably caused a leakage. The pressure was 500 volts, and Colburn would receive 250 volts.

The Coroner asked the witness how many volts a man could stand, and he replied that it depended upon the constitution. Some could stand a great deal; others very little.

The Coroner: Is it usual to feel these earth shocks?—Yes, if the machine is out of order or is working in water.

Dr. Stewart said he had made a post-mortem examination of the body of the deceased, and found all the organs healthy. The only scars were two large burns on the shoulder blades. Death was caused by paralysis of the heart, due to severe electrical shock.

Replying to the Coroner, witness said that death by electricity never affected the internal organs.

A Juryman: Could not non-conducting ropes be used?

Mr. Gill: They would be worse than steel. If dry, both are equally safe; if wet, steel would be less liable to carry and distribute moisture. We have used this power daily for 23 years and this is the first accident we have had.

A verdict was returned in accordance with the medical evidence.

An employé of Mr. Rowland F. Winder, electrical engineer, Cross Belgrave Street, Leeds, who had only started work for the firm a few hours' previously, met his death on Thursday night while working on an electric crane on the premises of Messrs. Drake, Upper Wortley. The man named Edward Brogden, 31 years of age, was, with James Foster, upon a 10-ton overhead crane, when they received orders to lower the collectors. When proceeding to do this Brogden stepped across the head of the crane and commenced to unscrew one of the holders. As soon as he did so he received a shock. Foster held him up and shouted for assistance. Upon the arrival of medical assistance the man was found to be dead.

On Friday last an inquest was held at Llwynypia touching the death of Edward Abbott, Tonypandy, who was electrocuted at the Glamorgan Colliery, Llwynpia, on the previous Wednesday evening. Mr. F. J. Trump, inspector of mines, represented the Home Office, and Mr. Leonard Llewelyn watched the proceedings on behalf of the Cambrian Colliery Co. It appeared that a haulier named Doel was driving a horse attached to two trams at the brickyard, when the horse fouled two stay wires supporting a derrick, and received an electric shock which killed it on the spot. Doel also received a shock, but recovered immediately afterwards. John Oriel, foreman, said he saw Abbott clutch hold of the hinder tram, to which the horse was attached. Abbott shouted. Witness ran to the power station to have the current cut off. When he returned Abbott was dead. According to the report of the *Western Mail*, Mr. Duncan M'Donald, chief electrical engineer, stated that the theory of the accident was that through the breakage of an insulator at the top of the derrick, supported by wire stays, the horse received a shock and fell against the stays. The stays attached to the derrick holding the electric cable were evidently affected by the broken insulator. A part of the rubber casing being broken caused a surface leakage, and it was evident that Doel's horse came within the influence of the leakage, causing it to plunge and fall across the stays. The Coroner, in summing up, said the question was whether the system now working was a good one. He suggested that, as electricity was in its infancy and they knew practically nothing about it, it should be taught to the children in school (!) The jury returned a verdict of "Accidental death," adding that no blame was attached to anyone.

Electric Power from Niagara.—The *Times* correspondent at Toronto says that the municipal system organised by the Ontario Government for the distribution of electrical energy generated at Niagara Falls will deliver power at Toronto in October, and at London and St. Thomas, 100 miles west of the Falls, by the end of the year.

NEW COMPANIES REGISTERED.

New Liverpool Rubber Co., Ltd. (109,933).—This company was registered on May 31st, with a capital of £150,000 in £1 shares (52,000 5½ per cent. cumulative preference), to take over the business carried on at Liverpool and elsewhere by the Liverpool Rubber Co., Ltd. (incorporated in 1894), and to carry on the business of manufacturers of and dealers in india-rubber and other gums, tires, rubber goods, cycles and vehicles, electricians, &c. The subscribers (with one share each) are:—F. H. Smith, Queen's Lodge, Colwyn Bay, rubber manufacturer; P. A. Birley, Cambridge Street, Manchester, india-rubber manufacturer; T. Fazakerley, 81, Stretford Road, Urmston, Lancs., manager; S. W. Dutton, 35, Birch Hall Lane, Longsight, Manchester; L. Brown, 15, Palatine Road, Withington, Manchester, manager; A. Whiteway, Moss Bank, Albert Road, Sale, Chester, manager; A. E. Walker, 80, Yarburgh Street, Manchester, manager. Minimum cash subscription, £10,000; the number of directors is not to be less than two or more than five: the first are F. H. Smith and P. A. Birley; qualification, £500; remuneration as fixed by the company. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

T. E. Morgan & Co., Ltd. (109,957).—This company was registered on June 1st, with a capital of £100 in £1 shares, to carry on the business of gas, electrical, mechanical and general engineers, light, heat and power suppliers, founders, plumbers, &c. The subscribers (with one share each) are:—T. E. Morgan, 367, Ecclesall Road, Sheffield, electrical engineer; O. Huxley, 42, Edgedale Road, Sheffield, engineer. Private company; the number of directors is not to be less than two or more than five; the first are T. E. Morgan and O. Huxley; qualification, one share; registered by the Midland Mercantile Association, Ltd., Fitzwilliam Street, Sheffield.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Coventry T.C. has increased the salary of MR. G. TOUGH, electrical engineer, from £350 to £450 per annum.

The marriage took place last week at Newport (Mon.) of MR. WM. ALBERT HUTCHINGS, chief electrical engineer at the Inysddu pits of the Risca Collieries Co., and Miss Maud Thomas, eldest daughter of Mr. Wm. Thomas, of Fernleigh, Tredegar Junction.

MR. H. A. GREENFIELD, of Northampton, late of the Norwich Corporation, has been appointed shift engineer to the burgh of Partick electricity department.

General.—MR. CHARLES BRIGHT, F.R.S.E., asks us to state that his appointment by the Australian Commonwealth, recently announced, is a home (London) appointment for partial services, and will not, therefore, as appears to have been supposed, take him to Australia.

MESSRS. CLARKE, FORDE & TAYLOR, of 4, Great Winchester Street, E.C., announce that on July 1st next they are taking into partnership Mr. Reuben Marchant Sayers, A.M.Inst.C.E. The style of the firm remains unaltered.

MR. B. C. EVANS, manager of the London depôt of Veritys, Ltd., has been appointed to a seat on the board of directors.

MR. MORSE, electrician at the Penrikyber Colliery, Penrhiwceiber, has obtained an appointment with the Vancouver E.L. Co., British Columbia.

MR. CECIL BARBER, A.M.Inst.C.E., M.I.E.E., for many years engineer and manager of the Bournemouth Corporation Tramways, has taken up the appointment of international secretary to the Warner Engineering Co., Ltd., and has been appointed a member of the Technical Advisory Committee, which is responsible for the approval of the designs made or supplied to the company's licensees in various countries. As international secretary Mr. Barber will deal almost entirely with the foreign railway, mining and consulting interests of the company, and will be responsible for the complete organisation in connection with the offices, agencies and works abroad. All communications to him should in future be addressed to the head offices of the company at Carteret Street, St James Park, S.W.

Obituary.—On June 3rd, MR. FRANK WRIGHT, consulting engineer, aged about 55 years, was found dead in a room in Old Queen Street, Westminster; the cause of death was gas suffocation, a gas jet and a gas ring being found turned fully on. The newspapers in their reports of the affair state that the deceased gentleman was the inventor of many patents connected with electric dynamos and incandescent gas. So far as we are aware, however, his principal and, we believe, his only electrical invention was one in connection with glass-blowing machines, taken out in conjunction with Mr. W. Mackie between the eighties and the nineties of last century. A far greater financial success was scored by Mr. Wright in his penny-in-the-slot gas meter. In recent years he had not moved much, if at all, in electrical circles; in his earlier years, somewhere approaching 1880, he was engaged as assistant to Mr. Lane-Fox in the British Electric Light Co.

CITY NOTES.

Kalgoorlie Electric Power and Lighting Co., Ltd.

Mr. Roger Wallace, K.C., presided on Thursday of last week over the fourth annual general meeting of this company held at Winchester House, E.C.

The Chairman, in moving the adoption of the report (see Electrical Review, page 925), said that the accounts showed a diminution in the profits for the last year. That was to be accounted for by the wood strikes, and also by the fact that one of their largest customers had the misfortune to have a large part of his works destroyed by fire. The effect of a sudden stoppage in the demand for current from a large customer must show itself in the accounts of a company, and consequently their profits reflected that point. Even in London when there were no fogs which entailed extra demand of current for lighting, the accounts of the electric companies showed a difference as compared with years when there were fogs. He did not anticipate that there would be any more wood strikes, for everything had now been satisfactorily settled. The strikes did not affect that company very much, as they were able to take wood out of stock, but they affected the mines who had not got any by them. He hoped that next year they would not have any of these difficulties to contend with, although, of course, it was impossible to say what might occur. Another item which had been against them was the raising of the price of water from 5*s.* to 7*s.* per 1,000 gallons, which had necessarily made the cost of production heavier. One of the great difficulties the company had to contend with was the constant offers by Continental firms to the small mines to put down plant—not only of the ordinary kind, but they were also putting down suction gas plant. This was extremely unfortunate, because Kalgoorlie was not a good place in which to use gas engines. In the meantime those who were using them would have to find out by experience that they were losing profits by not buying electrical energy from the Kalgoorlie Co. Then they were always threatened by the larger mines that they would put down plant of their own, so that the directors did not have an easy time of it in trying to hold their own. They would see from the report that the company, in order to meet the demand, had put down a new unit, and in order to do this they purchased an engine in this country. He was sorry to say, however, that the manufacturer did not deal with the matter in such a satisfactory way as Continental manufacturers of engines did. The engine supplied by the English firm had not worked so economically as those which had been purchased from Continental manufacturers. They had not, therefore, been able to produce the unit at as low a price as in the ordinary course they would have been able to do. The matter was, however, still *sub judice*. The only way in which they could expect to produce current cheaply was to have a large output, and in order to do that the directors had decided on laying down another new unit. The last one that they put down was paid out of capital and by loans from the bankers, which left them at the end of the year with a considerable overdraft. In the last case, however, the directors thought that it would be wiser instead of having an overdraft to issue debentures. This had accordingly been done, and they had been enabled to clear off the overdraft and put down the new unit. They had still 3,600 debentures unissued. He was pleased to see that the Government of Western Australia had inaugurated a new policy by which it was hoped that that part of the world might be opened up. In that case, the Kalgoorlie Co. would, of course, share in the prosperity. Then, again, he noticed from a recent speech that it was the intention of the Government to aid the companies which were at work in the Colony. It was all very well to talk of emigration, but they had to remember that there was a duty to help those who had sunk their capital in concerns in the Colony. At the present moment there were very high taxes on goods which could not be bought in Western Australia, and that very often deterred undertakings from incurring expenditure under the head of machinery. He was pleased to see that the Government had that matter under their consideration.

Mr. E. Pope seconded the motion, and the report was adopted.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

New York Telephone Co.—£1,000,000 4½ per cent. first and general mortgage 30-year bonds, Nos. C 10,001 to 15,000 and C 25,001 to 30,000, of £100 each (issued in Amsterdam).

Rangoon Electric Tramways and Supply Co.—Further issue of £28,213 4½ per cent. first mortgage debenture stock.

Prospectus.—*Northampton Electric Light and Power Co., Ltd.*—The directors are issuing—to existing shareholders—15,000 "B" shares of £1 each at 2½ per cent. premium. The capital is required for plant, buildings and mains extensions.

United Electric Tramways of Monte Video, Ltd.

The directors, in their report for the year to March 31st, 1910 state that the results of the operation of the tramway system for the year to October 31st, 1909, are as in the following table:—

	1908—9.	1907—8.	Inc. or dec.
Gross receipts	$1,190,310	$1,093,870	+ $96,440
Operating expenses	694,588	701,009	— 6,421
Net receipts	495,722	392,861	+ 102,861
At exchange of $4·7 to the £ ..	£105,472	£83,587	+ £21,885
Passengers carried	29,293,804	25,901,439	+3,392,365
Car-miles run	6,282,240	6,036,669	+ 245,571
Percentage of operating expenses to gross receipts	58·35	64·09	— 5·74

The extension of the power house and the installation of the new plant, referred to in the last report, are almost completed, and the additional rolling stock has been in service during the greater part of the year. Further extensions to the main car-shed and store shed, and other improvements which will enable the management to deal with the traffic in a still more efficient manner, have been authorised. Owing to the rapid development of Pocitos as a health resort, it has also been found necessary to authorise an extension of the company's hotel. The amount received from La Sociedad Comercial de Monte Video in respect of dividend and interest was £106,197. The profit and loss account for the year, after providing for administration expenses and charging £39,800 for debenture interest, shows a credit balance of £63,863. To this must be added the balance of £11,118 brought forward from last year, making a total to be dealt with of £74,981. There has been set aside for the purpose of the debenture stock redemption fund, £2,200. There has been transferred to renewals and contingency account £15,000. The following interim dividends were paid on December 15th, 1909, in respect of the half-year to September 30th, 1909: On the preference shares, at the rate of 6 per cent. per annum, less income-tax at 1s. 2d. in the £, £11,198; on the ordinary shares, at the rate of 4 per cent. per annum, less income-tax at 1s. 2d. in the £, £7,533 = £18,731. The directors now recommend the payment of the following dividends for the half-year to March 31st, 1910: On the preference shares, at the rate of 6 per cent. per annum, less income-tax at 1s. 2d. in the £, £12,136; on the ordinary shares at the rate of 8 per cent. per annum, less income-tax at 1s. 2d. in the £ (making 6 per cent. for the year), £15,067; leaving to be carried forward £11,848 = £39,050.

Anglo-Portuguese Telephone Co.

The directors in their report for the year ended December 31st last, state that provision has, as usual, been made to safeguard the company from any serious consequences arising from fluctuations in exchange during the current year. The profit and loss account shows a gross revenue of £49,489, of which operating, management and general expenses absorbed £27,239 and royalties to the Portuguese Government £1,487, leaving a gross profit of £20,767. After providing for debenture interest (£2,312), sinking fund (£1,297), income-tax (£596), and appropriating £7,500 to the reserve fund (which now amounts to £27,500), and £500 to the exchange fluctuation account (which now amount to £4,000), the amount available for disposal, including £4,820 brought forward from the previous year, is £13,392. In November last the directors paid an interim dividend of 3 per cent. (free of income-tax), amounting to £3,000. They now recommend a final dividend of 5 per cent. (free of income-tax), making a total distribution of 8 per cent. for the year 1909. This will absorb a further sum of £5,000, and leave a balance of £5,392 to be carried forward. As in previous years, the profit and loss account was credited only with the proportion of subscriptions for which the company had actually rendered service during the year. The proportion of the year's subscriptions unearned at December 31st, amounting to £18,119, has been treated in the balance-sheet as a liability of the company. During the year further extensions were made in the company's systems in Lisbon and Oporto. With a view to ensuring the company's service and plant being maintained in the highest state of efficiency, the directors arranged for an inspection of the system by Mr. F. Gill, the chief engineer of the National Telephone Co., Ltd. Mr. Gill, accompanied by Mr. Kerr and Mr. Kingsbury, two of the directors of the company, recently visited Portugal, and recommendations resulting from this visit are now being carried out. It is added that the company's relations with the Government and the various administrative authorities continue quite satisfactory.

Western Telegraph Co., Ltd.—The third quarterly interim dividend of 3*s.* per share, free of income-tax, for the year ending June 30th, 1910, being at the rate of 6 per cent. per annum has been declared. The transfer books will be closed from June 17th and 23rd.

Diesel Engine Co., Ltd.—The directors' report for the financial year ended March 31st, 1910, shows that the credit balance of profit and loss account is £2,956, plus £6,075 brought forward, making a total of £9,031 available for distribution, which is to be allocated in the following manner, viz., £938 in payment of a dividend of 5 per cent. on the preference shares; £5,000 to the general reserve account, increasing this reserve to £20,000, and carrying forward £3,093. Since the last ordinary general meeting, Mr. H. de Fonblanque Cox has resigned his seat on the board. The directors do not at present propose to fill the vacancy.

Brush Electrical Engineering Co., Ltd.

THE twenty-first general meeting of the shareholders of the above company was held on Monday at the Electrical Federation Offices, Kingsway, Mr. E. Garcke, the chairman, presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 924), said that last year, when he took over the chairmanship of the company, he did so without any illusion as to the difficulties to be incurred, or as to the responsibilities of the position. The past year had been one of great anxiety and worry to the directors and staff. The best that he could say was that his anxiety with regard to the position was less now than it was a year ago. In his opinion the troubles of that company, and all other undertakings similarly situated, were due to the excessive competition to which they were opposed, particularly from abroad. The foreign competition for electrical orders in this country was very keen, and reduced not only the output of the English manufacturer but also the prices which they were able to obtain for their manufactures. It hit them also in other ways; the cost of obtaining orders was enormously increased by the competition, and, of course, it intensified the competition which in any case would exist in English circles. If it were not for imports from abroad manufacturers might be able to come to terms in regard to this mutual destructive competition; but under the existing state of affairs nothing was to be gained by an agreement between English manufacturers. These unsatisfactory conditions had been accentuated during the past few years by the advent of the metallic-filament lamp, reducing the necessity for power house extension plant. The company were also, as they knew, largely interested as manufacturers of rolling stock, and in that respect they had been particularly hit during the last few years, by the fact that there had been very few extensions of railways, tramways or light railways, in this country. Consequently, the little profit which they were able to make on their engineering side was more than utilised by the costs of keeping open the rolling stock shops which were not fully employed. Under these circumstances there was nothing to be done, but to attend closely to the details of the business, and to reduce expenses to the smallest possible limits, and to hold their own until conditions improved. All electrical manufacturers in this country were in a similar position; some were, perhaps, better off than others, but all were working under most unfavourable conditions. They had, during the past two years, made substantial reductions in their expenses. These reductions were to some extent the result of reduced volume of business, and did not imply any unnecessary expenditure in the past, but, nevertheless, it was satisfactory to observe that they had been able to make large reductions in their standing charges in response to the smaller volume of business. He was glad to say that during the current half-year business had been, to some extent, better. The engineering shops were more full of orders at the present moment than they had been for some time past, but until the general confidence in regard to industrial undertakings in this country was revived, they saw very little prospect of receiving sufficient orders for rolling stock to keep their large carbuilding shops employed. He could make a long speech explaining their troubles, but he thought little would be served by doing so. There was nothing more to say except to assure the shareholders that everything was being done by the directors and the staff to improve the position of the company. As chairman of the company he gave his attention to its affairs. Mr. Madgen, as its vice-chairman, had attended to the business practically to the exclusion of all other interests, and he could not speak in terms of too high praise of the services rendered to the company by its officers. Than Mr. Broadhurst, the general manager of the company, who had had more than 30 years' experience of the electrical industry, he did not think there was any gentleman in the industry who had more intimate knowledge of the commercial aspects of the business. Mr. Steinitz, their other general manager, was doing exceedingly well in dealing with the difficulties of the company, and it would be very hard for the directors to find anyone who could render more indefatigable or able services to the company than those which that gentleman had done in the past. Having made those few remarks about the chief officials, he would like to say the same of the general staff, who were working against the adverse circumstances which the company had to face. With efforts of that kind he was sure they must be successful—the present was an anxious time, and the shareholders must be patient.

MR. W. L. MADGEN seconded the motion.

MR. MARCHANT remarked that he knew something of the electrical industry, and he agreed with the chairman's remarks. He would, however, like to hear some information as to the company's figures.

The CHAIRMAN said he would be most happy to explain anything which was not clear in the report. There was very little to be gained by comparing the figures with those of previous years. He had said that the expenses showed a reduction, and the report referred to the fact that those economies were not brought out in the accounts because a large part of the economies were included in the gross profit and loss account before arriving at the balance shown.

MR. CATHCART said it appeared they had lost £21,000 during the past year, giving them a total loss on the undertaking of £50,000. He would like to know whether they would be able to meet their fixed charges.

The REV. MR. HILL said that he gathered from the auditor's report that the value of the shares of the debentures showed a reduction; some of the patents had expired, so that the price of the goodwill was below what it was credited to be, and no sum for depreciation had been allowed for the last three years. Altogether out of a capital of £330,000 they had lost £100,000, and who could tell that £200,000 might not be lost. He asked whether it was not possible to get some information as to the approximate amount of money that had been lost. It was stated in the last report that it was hoped that the metallic-filament lamp would afford a means of fresh fields for the company, but he saw no reference to that in the report now submitted.

The CHAIRMAN said he had really said all that he could say. They had the report before them, and they could see for themselves what had been done. As to the hopes held out through the introduction of the metallic-filament lamp, they were engaged in that, but there had been some delay in putting the lamp on the market. The last speaker had correctly interpreted the auditor's report, and he was in as good a position of reading the accounts as he (the Chairman) was. They could not expect him in the difficult position which he occupied to make a lengthy speech. He had only been the Chairman for a year, and he would rather not make any statement which he would be responsible for at the next meeting. All he could say was that they apparently understood the position as truly and accurately as the directors did. They, perhaps, did not understand the amount of work that the board did in order to maintain the company's position. The shareholders could do no good by rubbing in the loss the company had made. The directors were making every effort to retrieve those losses. No one could do more than they were doing. They would not leave a stone unturned to improve the position of the company, and they sincerely hoped that next year they would be able to submit a more encouraging report.

A SHAREHOLDER reminded the Chairman that he had not dealt with the question of the company being able to meet its fixed charges.

The CHAIRMAN said they had every determination to go on with the company, with the intention of retrieving its position, and obviously they could not go on if they did not do so with full faith to their creditors. They must meet their liabilities, therefore, what could be the use of asking the question whether they were likely to meet their fixed charges? They must do so, or not go on, and they meant to go on.

The report was adopted.

Stratford-on-Avon Electricity Co., Ltd.

THE directors' report to December 31st, 1909, states that the sum of £100 has been placed to a reserve and depreciation fund, and the balance of £153 has been carried forward.

	1908.	1909.
Units generated	71,340	102,845
Units sold	43,551	77,055
Lighting	17,451	33,456
Power	23,345	39,710
Heating	2,755	3,889
Used on works	20,089	19,240
Unaccounted for	7,700	6,550
8-c.p. lamps connected	6,496	8,456
Maximum load in KW.	76	76

Torquay Tramways Construction Syndicate, Ltd.

THE third annual general meeting was held at 21, Cornhill, London, on Monday.

MR. L. B. SCHLESINGER presided, and moved the adoption of the report and accounts for the year to December 31st last, along with those of the Torquay Tramways Co., Ltd., for the same period. The profit on the year's working, he pointed out, was £2,427, and that sum had, with the approval of the directors, been carried forward. The traffic receipts showed an increase of £490 over those of the previous year, but owing to the heavy costs of working the surface contact system there was a decrease in profit. The Board of Trade had intimated that they would not renew their sanction to the use of surface contact system after October 31st next, and in consequence, negotiations have been opened with the Corporation for installing the overhead system. The Corporation had in the past dealt very fairly with the company, and from what had transpired there was every reason to assume that their consent to the overhead system would be given at an early date. Powers for the extension of the tramways on the overhead system to Paignton had been obtained, and when this line was constructed and the overhead system installed in Torquay, there would be a large increase in the net profits of the company. The capital for the construction and equipment of the extension would have to be raised by an issue of prior lien debentures, which would be amply secured. The shareholders would be given an opportunity of underwriting part of the issue, and the directors trusted that substantial support would be forthcoming, as the future prosperity of the undertaking depended entirely upon this capital being raised.

MR. W. HERBERT FOWLER seconded, and the report was adopted.

National Electric Construction Co., Ltd.—The accounts for the year to December 31st show that, after providing for debenture interest, depreciation, &c., the credit balance of £9,651 brought down was reduced to £6,322.

Anglo-Argentine Tramways Co., Ltd.

The ordinary meeting of the shareholders of this company was held on Wednesday last week at Gresham House, Old Broad Street, E.C., Mr. J. B. Concanon presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 834), said that their operations during the year 1909 resulted in their having carried 223,823,792 passengers. The total receipts amounted to £1,938,887, and the expenditure, including £50,000 carried to the depreciation renewal funds, totalled £1,207,222, leaving a net profit of £731,665. After providing for all fixed charges, dividends on both classes of preference shares, nine months' rent of the metropolitan tramways, and the share capital sinking fund, the surplus balance at credit of net revenue account was £140,972. From that had to be deducted the interim dividend paid on the ordinary shares, and the further dividend which they now recommended upon them, together £130,625, leaving a balance of £10,347 to be carried forward. Owing to the fusion, no useful comparison could be made with the previous year's working, and the full benefits which they anticipated therefrom were not possible during 1909, as they did not enter into possession of the various lines they took over until April 1st, and it required some months afterwards to make the necessary junctions and readjustments of routes. On the other hand, their expenses were exceptionally heavy. The municipal authorities, in anticipation of the centenary which was now being celebrated in the Republic, undertook a large amount of street repaving work last year, and they took the opportunity to relay a considerable portion of their lines on a deeper concrete base, although they would have lasted a few more years before the work became actually necessary, and this work entailed a heavy expenditure under the head of permanent way. The outlay upon their rolling stock was also very large, painting being a big item, as they wished to have all the cars of a uniform colour. In all, revenue was debited under the head of maintenance with £207,486, in addition to which £83,648 was expended upon renewals. The working of the entire system for the first four months of this year would give them a clearer indication of the advantages which had already resulted from the fusion. The profit in Buenos Ayres from January 1st to April 30th last amounted to £316,433, and he thought that, without being at all sanguine, they might fairly anticipate that the profits for the remainder of the year would be at least in the same proportion, or, say, £950,000 for the whole year. Deducting therefrom the London expenses, and taking credit for sundry receipts, there would remain a surplus of £940,000. The city company annuity, interest and sinking fund on debentures, dividends and sinking fund on the first and second preferences, and the rent of the Metropolitan Tramway, required a sum of £665,000, leaving a balance of £275,000 available for renewal funds appropriation and dividends on the ordinary shares. Coming to the question of the new concession which they had obtained for the construction of subways, no doubt many of them would feel surprised that "in view of the very great success they were achieving from their present system of surface lines, they should embark upon an enterprise which was somewhat novel in this country at least, and one involving such a large expenditure of new capital. But before he referred to the reasons which actuated them, he wished to correct some misconceptions which appeared to have entered into the minds of some of the shareholders; the most important of which was that the entire issue of the proposed new debenture and share capital, totalling £8,000,000, would be required for the construction and equipment of subways. That idea was a mistake. They estimated, and they believed their estimate was on the safe side, that the total cost of the subways and their equipment would not exceed £5,000,000 all told, and further he might point out that the execution of the work would be spread over a considerable number of years. They thought that the last section could not be constructed before eight years. Fears also appeared to be entertained that the removal of two miles of surface lines in the heart of the city would involve a loss of earning capacity. Seeing that before they took up the rails the subways would be working, and that the congestion of traffic in the radius affected was so great even now that the speed of the cars had to be reduced to walking pace, entailing excessive running expenses, they believed they had very little, if anything, to lose by complying with this stipulation on the part of the municipality. The directors did not embark upon this big enterprise without the most careful thought and study of the question in all its bearings. They had to consider the fact that the population of Buenos Ayres was augmenting in a remarkable degree. It had increased from 800,000 to 1,250,000 within the past five or six years. They came to the conclusion that it was absolutely necessary to provide for the future, and they decided not to allow the honour and profit of the efficient carrying of the travelling public to fall into the hands of others. They, therefore, entered into negotiations with the municipal authorities who met them in the most enlightened public spirit. They gave them the subway concession, the main features of which were in the report, and the directors were perfectly satisfied with its conditions. The combined working of surface and subway tramways was seen in London in a small way in the line which ran from Aldwych to the Embankment. It was also working successfully in other countries, notably at Boston, U.S.A., and from his own personal knowledge of Buenos Ayres and the situation of their lines and the configuration of the city, he had no hesitation in saying that he considered the conditions for working were ideal, both as regarded public utility and as a profitable enterprise. They anticipated that the working expenses of the subways would be only about 45 per cent., as against 60 per cent. at present on the surface lines. The estimates of the manager, which was endorsed by the chairman of the local committee, was that the additional net results from working the subways would leave a very substantial surplus after providing the necessary interest and sinking fund on the additional capital. The board estimated that if the proposed capital was raised it would leave them £2,000,000 available for possible further extensions.

Mr. J. Heaton seconded the motion, and the report was adopted.

The following resolutions for the increase of the capital were also agreed to after a short discussion:—

That the directors be and they are hereby authorised to create and issue £6,000,000 of 5 per cent. debenture stock ranking as a floating charge upon the company's undertaking, property and assets for the time being both present and future (including its uncalled capital) immediately after the £1,733,380 4½ per cent. debenture stock already issued by the company, and redeemable at par within 80 years from 1910 by means of an annual sinking fund commencing in 1916, but with power to the company to redeem the stock or any part thereof at 103 per cent. at any time after December 31st, 1930, on six months' notice.

That the directors be and they are hereby authorised to increase the capital of the company by £4,000,000 by the creation and issue of 100,000 new second preference shares of £5 each (to be numbered 1,900,001 to 1,900,000 both inclusive) ranking *pari passu* as regards distribution of assets, dividends and voting with second preference shares of the company already issued and by the creation and issue of 300,000 new ordinary shares of £5 each (to be numbered 1,900,001 t 2,200,000 both inclusive) ranking for dividend, and in all other respects *par passu* with the existing ordinary shares of the company. The said additional 300,000 ordinary shares as from time to time issued shall in the first place be offered for subscription proportionately to the ordinary shareholders on the Register at the time of issue.

A further resolution was carried increasing the dividend on the first and second preference shares from 5 to 5½ per cent. per annum from January 1st next.

Paris Metropolitan Railway Co.

The report for 1909 of the directors of the Compagnie du Chemin de Fer Métropolitain de Paris, deals at length with the tunnel and other constructional works carried out by the City of Paris, the permanent way and other works undertaken by the company, and the works in progress or in contemplation. It is intended to increase the number of bays so as to further improve the ventilation of the tunnels, and to erect further lifts at different stations. The length of line in operation at the end of 1909 was 35 miles, and this was advanced to 37½ miles on January 9th, 1910, by the opening of the last section of the Raspail-Châtelet line. The number of employés of all grades rose from 4,114 at the close of 1908, to 4,466 at the end of 1909, and the system of giving bonuses to encourage the men in the efficient working of the railway was maintained and developed, the amount of the payments having been £23,300, as compared with £19,800 in 1908. In addition, the company continued to facilitate the erection of workmen's dwellings for the accommodation of the *personnel*, and over £20,000 had been advanced for this purpose by December 31st, 1909. The money was lent partly at the rate of 2½ per cent., to be repaid in 12 years, and partly at 3 per cent., with redemption in 20 years, and 79 houses had already been built on this basis. A separate company, in which the railway company held most of the share capital, had also been formed, with a capital of £20,000, to build and let dwellings to the railway workers, and the maximum rate of divisible dividend had been fixed at 3 per cent. The accounts show the following results for the past two years:—

	1909.	1908.
Share capital	£3,000,000	£3,000,000
Bond ,, ...	3,000,000	3 000,000
Total receipts	1,793,000	1,626,400
Working expenses	755,200	683,400
Municipal share in gross receipts	586,000	530,700
Net profits	339,400	357,600
Dividend	231,900	238.000
,, per cent.	8	8
No. of passengers carried	254,445,992	229,700,519

It will be seen that the net profits declined as compared with 1908, the explanation being found in the reduction in the average net receipts per mile owing to the low efficiency of No. 6 line, which was set in operation in March, 1909. Apparently the company makes no provision for depreciation of the permanent way, rolling stock and other electrical equipment, &c., but against this has to be set the circumstance that the ordinary share capital as well as the bonds are gradually being redeemed, and the sum of £42,000 has been approximated for the redemption of 4,280 shares during the past year.

The report also refers to the overflow of the Seine at the end of January, which flooded about 12 miles of the railway, notwithstanding all the precautions taken to arrest its progress, including the installation of electric pumps. The service on the lines affected was completely stopped and has only been resumed gradually. At various points the railway was directly inundated from the Seine, whilst at other parts the sewers and the underground section of the North-South Railway are blamed for the incursion. It is estimated that the loss of revenue incurred, and the damages caused by the flooding, represent from £80,000 to £120,000. It has been decided to raise fresh bond capital to the amount of £3,000,000, which is to be issued gradually, for the purpose of proceeding with the works incidental to the lines forming the subject of the most recent concessions.

Traction and Power Securities Co., Ltd.—The report for the year 1909 states that the profit and loss account shows a credit balance of £24,848, which, added to £5,775 brought forward, gives a total sum of £30,623 to be dealt with. Out of this the directors have transferred £25,000 to the investment reserve account, leaving £5,623 to be carried forward. The investment reserve account now stands at £110,000.

MARKET QUOTATIONS.

Wednesday, June 8th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£10	..
a Copper Sulphate	„	£18	..
a Lead, Nitrate	„	£26	..
a „ White Sugar	„	£23 10	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a „ Chlorate	per lb.	8½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	70/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70 %) ..	„	£11	..
a „ Chlorate	per lb.	8½d.	..
a „ Crystals	per ton	£9 5	..
a Sodium Bichromate, casks ..	per lb.	8d.	..
a „ Cyanide (basis 100 %) ..	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£80	..
b „ Wire, in ton lots ..	„	£112	..
b „ Sheet, in ton lots ..	„	£120	..
p Babbitt's metal ingots	„	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7¾d.	..
c „ Tube (brazed)	„	8¾d.	¼d. dec.
c „ „ (solid drawn) ..	„	6¾d.	¼d. dec.
c „ Wire, basis	„	6¼d.	..
c Copper Tubes (brazed)	„	9d.	¼d. inc.
c „ „ (solid drawn ..	„	8¾d.	¼d. inc.
g „ Bars (best selected) ..	per ton	£70	..
g „ Sheet	„	£70	..
g „ Rod	„	£70	..
e „ (Electrolytic) Bars ..	„	£59 10	10/- dec.
e „ „ Sheets ..	„	£75 15	10/- dec.
e „ „ Rod ..	„	£64 5	10/- dec.
e „ „ H.C. Wire	per lb.	7¾d.	..
f Ebonite Rod	„	6/-	..
f „ Sheet	„	5/6	..
n German Silver Wire	„	1/6	..
h Gutta-percha, fine..	„	..	..
h India-rubber, Para fine	„	9/2	10d. dec.
l Iron Pig (Cleveland warrants) ..	per ton	49/6	6d. inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Ingot	„	£12 17 6	..
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 15	..
d Mica (in original cases) small ..	per lb.	6d. to 1s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large ..	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	11d.	..
p „ „ rolled bars & rods	„	1/3	..
p „ „ rolled strip & sheet	„	1/3	..
o Platinum	per oz.	125/6	3/6 inc.
e Silicium Bronze Wire	per lb.	8¾d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£148 to £149	£1 10 dec.
n „ Wire, Nos. 1 to 16	per lb.	1/10	..
p White Anti-friction Metals:—			
"Ibis" brand	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£26	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n F. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p London Phosphor Copper & Bronze Co., Ltd.
r W. F. Dennis & Co.

Lyme Regis Electric Light and Power Co., Ltd.—The annual meeting was held at the Victoria Hall on Saturday. Mr. A. J. Woodroffe (chairman) presented the report of working to March 31st, showing a credit balance (including stock in hand) of £153 on revenue account. These figures were for only nine working months, and, in fact, although lighting in respect of the Corporation contract was commenced on June 1st, it was some time later before the company were able to connect up any private consumers. The turbine at Higher Mill did some very useful work during the winter, the total hours for the six months from October to March being 4,315, and engine hours 364. From the *résumé* drawn up by the engineer (Mr. C. Balbiani), they would see the private consumers numbered 36, and that they had instructions in hand to connect up a further 4, making a total of 40. The balance-sheet showed that the whole of the £3,500 share capital issued had been taken up, and that the expenditure under that heading amounted to £3,449. The report and accounts were adopted.

STOCKS AND SHARES.

Tuesday Evening.

PROFOUND depression settled over many of the Stock Exchange markets at the beginning of the week. The reduction last Thursday in the Bank of England minimum had been anticipated, as usual, with too much eagerness, and the consequence was that prices gave way after the announcement. A recovery in Consols helped other markets not a whit, and the luckless Home Railway list is once more slipping back into a state bordering upon stagnation.

The deflation of the rubber boom proceeds apace. Prices have come down heavily. Whereas, a month ago, rubber was by universal consent certain to touch 15s. before the summer time, now the majority view veers over to the likelihood of the price going to about half that figure. Speculation in rubber shares on the bull tack has received a very violent jar, which, combined with another, administered by a slump in American Rails, sent intermittent spasms of weakness radiating into other sections, and led to a steady withdrawal of public support.

Anglo-American Telegraph Deferred stock has been dancing up again, in spite of fresh denials as to there being any truth in the rumour of agreement with the Commercial Cable. The market seems to be fully convinced that there is more in the rumour than in its contradiction, but the best prices could not be maintained, and on the fall in American Rails, Anglo "A" came down, too. On balance there remains a small rise on top of the very substantial gains secured during the last three weeks. Neither the Ordinary nor the Preferred have advanced further, the chief rise in this connection falling to Direct United States shares, which went up to the extent of 30s. for the same reason as inspired the jump in Anglo stocks. But here again the advance was partially lost. Commercial Cable Debenture rose 1, and the Mackay Companies' issues are unchanged.

Indo-European Telegraphs are 10s. better, and other telegraph descriptions present no new features of interest. Telephone descriptions keep fairly firm. United River Plate Preference are exceptional, with $\frac{1}{16}$ fall. Other movements are very retail.

In the Home Railway section, the only alteration in electrical stocks consists of a fall of $\frac{3}{4}$ in Metropolitan Consolidated. There was an improvement at one time in the stock, upon the success of the new Pullman cars which the company has started, but this advance became lost. The absence, after so many years, of any exhibition from Earl's Court, would have been construed as a big bear point once, but it goes for little nowadays. Tube stocks are quiet and neglected.

It is a matter for frequent conjecture why the London and South-Western Railway does not take steps to improve its dirty, noisy, ill-ventilated and uncomfortable electric "pea-shooter," called the Waterloo and City Railway, between the terminus and the Bank. At an outlay that need not run into any vast sum, the miserable affair could be wonderfully reformed, and that the money would earn good interest there can be no doubt, for many travellers are lost who now go to Cannon Street by the South-Eastern, or else walk, or 'bus, from Waterloo to the City, and *vice versa*.

Amongst electricity supply shares, there are the regular, monotonous declines to be noted in the Metropolitan group. Westminsters stand out pleasantly with ½ rise, but Bromptons, Citys and St. James's shares are all lower to an equal extent. River Plate Electricity Preference have gained $\frac{1}{16}$, which is not surprising, for they must be considered a good investment, now that the company has established its financial position so firmly. The Mexican issues are good, Mexican Light and Power Common being 2 better at 81.

Mexico Tramways issues have moved curiously, a fall of 1½ in the shares being picked up by the first mortgage bonds. Rio Trams at 96½ are 1 lower, but bonds are steady at 99 and 88½ for the first mortgage, and the fifty-year bonds respectively. Anglo-Argentine Tramways continue their quiet recovery, and arrangements are being made for an early issue of about 1½ millions Debenture stock, out of the six million pounds authorised. Some of the proprietors of the shares say that although they declined to realise when the prices fell so sharply a fortnight ago, they will watch for a good opportunity to get out should such a chance present itself, in order to cut their connection with a company which certainly has a huge capital, under the new scheme. British Electric Tractions go on sagging away. The Preference shares at 3½ show a further loss of half-a-crown. Miscellaneous issues are all very quiet.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations May 31st.	Closing Quotations June 7th.	Business done week ended June 7th, 1910. Highest	Lowest	Rise + or Fall —	Present Yield per cent.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	8⅜ — 8⅞	8⅜ — 8⅞	..	..	..	£ s. d. Nil.
116,200	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	100 —102	100½ —102½	..	..	+ ⅛	4 17 7
$255,196,000	American Telephone & Telegraph, Cap. Stock ..	$100	8 %	8 %	8 %	8 %	140 —142	138 —140	..	..	—2	5 14 4
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 8
558,460	Anglo-American Telegraph	Stock	3½%	3½%	£3 4s.	3⅜%	64 — 66	64 — 66	..	..	..	6 9 6
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	104 —106	104 —106	106½	105	..	b 13 2
3,220,770	Do. do. do. Deferred	Stock	1⅜%	1 %	8/-	25/-	26⅜ — 26⅞	26⅜ — 27	28 1/16	26	+ ⅛	4 12 7
47,736	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	8 %	7 1/16 — 8 1/16	7 1/16 — 7 3/16	..	..	..	4 18 6
2,449,176	Commercial Cable, Sling. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	85 — 87	86 — 88	87	86	+1	a 10 11
16,000	Cuba Telegraph	10	6 %	6 %	6 %	6 %	8½ — 9	8½ — 9	8¾	..	..	6 13 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16½ — 17½	16½ — 17½	..	..	..	5 17 8
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3⅛ — 3⅜	3⅛ — 3⅜	..	..	..	5 3 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	7⅜ — 8½	7⅜ — 8½	..	..	..	6 1 3
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
60,710‡	Direct United States Cable	20	4⅜%	4½%	4⅜%	4 %	14 — 14½	15 — 15½	16½	14 1/16	+ ⅜	5 3 3
89,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,988, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	7 %	133 —136	133 —136	135	133	..	5 2 11
2,000,000	Do. 5½ % Pref. Stock	100	5½%	5½%	5½%	5½%	85 — 87	85 — 87	86¼	85½	..	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	101 — 103	101 —103	..	..	..	b 17 8
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	12⅜ — 13⅛	12⅜ — 13⅛	13 1/16	12 25/32	..	5 5 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
200,000‡	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	99½ —101½	99½ —101½	99½	..	..	3 18 10
181,127	Globe Telegraph and Trust	10	5½%	5⅞%	5⅝%	5⅞%	10⅜ — 10⅞	10⅜ — 10⅞	10⅝	10 5/16	..	5 5 9
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13 — 13½	13 — 13½	13⅜	13¼	..	4 8 11
150,000	Great Northern Telegraph, of Copenhagen	10	20 %	20 %	18 %	..	20½ — 21½	20½ — 21½	..	..	..	5 16 8
5,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	18 %	53¼ — 54½	53 — 55	..	..	+ ⅛	6 13 8
$41,380,400	Mackay Companies Common	$100	3½%	4 %	4 %	4½%	90 — 93	90 — 94	..	..	..	4 11 5
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	77 — 80	77 — 80	..	..	..	5 0 0
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	1⅛ — 1⅜	1⅛ — 1 1/16	1⅜	1 1/16	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	6 %	⅞ — 1	⅞ — 1	1	1/-	13/8	..	6 0 0
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	⅞ — ⅞	⅞ — ⅞	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104½ —106	104½ —106	105	104⅜	..	5 13 2
3,725,000	Do. do. Def. Stock	100	6 %	6 %	6 %	6 %	124 —126	124 —126	125	124	..	4 15 3
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	10⅜	..	..	5 15 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	10⅜	10	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅜ — 5⅝	5 7/16	5 1/16	..	4 10 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	97 — 99	97 — 99	..	..	..	3 11 8
1,988,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	100⅛	..	..	3 18 5
179,818	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	8 %	8 %	8 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	28/9	..	..	4 14 10
50,000	Do. do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/16	1 1/16 — 1 1/16	..	..	..	4 14 9
195,955	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	87 — 89	88 — 90	..	..	+1	4 8 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	98½ —100½	98½ —100½	..	..	..	3 18 10
11,889	Reuter's	5	5 %	5 %	5 %	5 %	7⅛ — 8 xd	7⅛ — 8 xd	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100½ —102½	100½ —102½	..	..	..	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	128 —131	128 —131	..	..	..	4 11 7
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	7⅜ — 7⅝	7⅜ — 7⅝	7⅜	7½	..	5 8 6
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5 7/16 — 5 9/16	5 7/16	..	— 1/16	4 13 0
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1 1/16 — 1 1/16	1 1/16 — 1 1/16	..	..	..	4 6 11
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	98½ —100½	98½ —100½	..	..	..	3 19 7
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980 ..	10	7 %	7 %	7 %	..	13½ — 14½	13½ — 14½	14 1/16	13⅜	..	4 18 3
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	b 18 3
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	8 %	6 %	6 %	..	8⅝ — 9⅛	8⅝ — 9⅛	..	..	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	15 %	..	8 — 9	8 — 9	..	..	..	16 12 9
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —103	100½ —102½	102⅛	102	— ½	4 17 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1s Pref., 1 to 640,000	5	..	..	..	5 %	4½ — 4⅝	4 5/16 — 4 7/16	95/-	91/3	+ 1/16	5 2 7
500,000	Do. 5 % 2nd Pref., 800, to 1,800,000	5	..	..	..	5 %	4⅜ — 4½	4 5/16 — 4 7/16	93/6	..	+ ⅛	5 9 7
4,465,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	90½ — 92	90 — 91½	91½	90½	— ⅛	4 7 5
382,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	105 —107	105 —107	..	..	..	4 13 6
880,000	Babcock & Wilcox, 1 to 880,000	1	20 %	20 %	20 %	24 %	5⅜ — 5 5/8	5 7/16 — 5 5/8	5½	5 7/16	..	4 9 6
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	5	6 %	6 %	6 %	6 %	1 1/16 — 1 1/16	1 1/16 — 1 1/16	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	Nil	..	..	..	..	..	..	Nil
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	3¾%	..	..	..	..	..	..	..
40,100	Do. do. "A" 6 % Cum. Pref. ..	5	6 %	6 %	6 %	..	..	..	..	..	..	..
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	2 %	..	..	..	..	..	..	..
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	5½%	5½%	5½%	5½%	97 —100	97 —100	..	..	..	5 10 0
500,000	British Columbia E. Rail Def. Ord. Stock ..	100	6 %	8 %	8 %	8 %	142 —147	142 —147	143½	..	..	5 8 7
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	122 —126	122 —126	125½	123½	..	4 15 3
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	109 —112	109 —112	111½	110	..	4 9 3
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,500	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
133,301	British Electric Traction	10	Nil	Nil	Nil	..	⅜ — 1½	⅜ — 1½	..	..	..	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	9 %	1½%	..	3⅛ — 3⅜	2⅝ — 3⅜	..	..	— ⅛	4 8 11
1,473,553	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	90 — 93	89 — 92	91	90	—1	5 8 8
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	..	66 — 71	66 — 71	..	..	..	6 6 9
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	6¼ — 7	6¼ — 7	6⅞	6⅝	..	7 2 10
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5⅝ — 6⅛	5⅝ — 6⅛	..	..	..	4 16 0
600,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
204,940‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	..	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
1,316,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	59 — 62	59 — 62	59½	..	..	6 9 1
50,000	Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	15/6 to 15/6	15/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,791 ..	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
900,000	Do. do. Non-cum. 6 % Pref.	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	39 — 44	39 — 44	..	..	..	10 4 6
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	25 — 29	25 — 29	..	..	..	15 3 0
187,610	Calcutta Trams, 1 to 187,610	5	8 %	6 %	4½%	4½%	4⅜ — 4⅞	4½ — 4⅞	93/9	91/3	..	4 14 9
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	5	5 %	5 %	5 %	5 %	4⅜ — 5	4⅜ — 5	..	..	..	5 0 0
950,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
95,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	10 %	9¼ — 10¾xd	9½ — 10⅞	9⅛	..	..	4 17 7
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5 — 5⅜	5 — 5⅜	..	..	..	4 13 0
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102¾ —104½	102½ —104½	..	..	..	4 6 2
491,223	Cape E. Trams., 1 to 491,223	1	Nil	Nil	Nil	..	3/16 — ¼	3/16 — ¼	6/3	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	12½%	2 1/16 — 2 1/8xd	2 1/16 — 2 1/8xd	51/3	..	..	4 7 9
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	104 —107	106 —109	..	..	+2	4 2 7
1,890,690	Central London Railway, Ord. Stock	Stock	4 %	3 %	3½%	3 %	71 — 73	71 — 73	71⅛	71	..	4 2 2
554,555	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	86 — 88	86 — 88	87⅛	87	..	4 10 11
554,555	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	53 — 55	53 — 55	53⅝	..	..	3 12 9
1,480,000	City and South London Railway	Stock	3½%	2½%	1½%	1½%	33 — 34	33 — 34	33½	33½	..	5 2 11
85,000	Crompton & Co., Nos. 1 to 85,000	5	5 %	5 %	Nil	..	⅜ — ½	⅜ — ½	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	88 — 91	88 — 91	..	..	..	5 9 11

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909	Closing Quotations May 31st.	Closing Quotations June 7th.	Business done week ended June 7th, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	6 %	..	1 7/16 — 1 9/16	1 1/16 — 1 1/16	..	..	..	5 1 1
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 — 1 1/8	1 — 1 1/8	23/1 1/2	..	..	5 6 8
271,080	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 7 8
99,961	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,961	5	4½%	2½%	Nil	..	1/16 — 1/16	1/16 — 1/16	..	..	..	Nil
17,189	Do. "A" shares, 01—017,189	5	4½%	2½%	Nil	..	1 — 1 1/8	1 — 1 1/8	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	65 — 70	65 — 70	..	..	..	5 14 4
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	79 — 82	79 — 82	..	..	..	6 1 11
112,100	Electric Construction, 1 to 112,100	1	Nil	Nil	Nil	..	1/2 — 5/8	1/2 — 5/8	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	1	7 %	7 %	7 %	7 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	9 0 8
35,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7 1/2 — 8 1/2	7 1/2 — 8 1/2	..	..	..	6 1 8
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	82 — 86	82 — 86	..	..	..	4 18 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	1/2 %	Nil	..	3/4 — 1	3/4 — 1	..	..	..	Nil
98,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	..	..	10 1/2 — 10 3/4	10 1/2 — 10 3/4	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 — 103 1/2	102 — 103 1/2	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15%	15 %	15 %	11 7/8 — 12 3/8	11 7/8 — 12 1/8	12	..	— 1/4	6 3 8
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5 1/8	6 — 5 1/8	5 3/16	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	103 —105 xd	103 1/2 — 105 1/2	..	..	+ 1/2	4 5 4
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	10 %	10 %	10 %	10 %	14 3/8 — 15 1/2	14 3/8 — 15 1/2	14 1/2	..	..	6 10 1
27,500	†Liverpool Overhead Railway, Ord.	10	Nil	1/2 %	Nil	Nil	3/4 — 7/8	3/4 — 1 1/16	..	..	— 5/32	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5 1/4 — 5 1/2	5 — 5 1/2	..	..	+ 1/4	9 1 10
600,070	London United Trams. (1901), 1 to 50,007	10	8 %	8 %	Nil	..	1 3/8 — 2 1/8	1 1/4 — 2 1/8	..	..	..	Nil
899,980	Do. do. 60,008 to 100,000	10	8 %	8 %	Nil	..	1 1/2 — 2 1/8	1 1/4 — 2 1/8	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	3 2/3 %	..	2 1/4 — 2 3/4	2 1/4 — 2 3/4	46/3	..	..	13 12 8
1,649,980	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	..	4 %	4 %	68 — 72	67 — 71	68 1/2	..	1	5 12 8
5,782,062	Metropolitan Consolidated	100	1 %	1/2 %	1/2 %	1 %	42 1/4 — 43	41 3/4 — 42 1/4	43 1/2	41 5/8	— 3/4	2 7 4
2,640,914	Do. Surplus Lands	100	23/4 %	2 1/2 %	2 1/2 %	2 3/4 %	66 — 68	66 — 68	67 3/4	66	..	4 0 11
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	23 1/2 — 23 3/4	23 1/2 — 23 3/4	23 5/8	23 1/4	..	Nil
891,887	Metropolitan Electric Trams., Ord.	1	..	..	4 1/2 %	..	2 3/32 — 2 5/32	2 3/32 — 2 5/32	..	..	..	5 15 0
314,016	Do. do. Defd.	1	Nil	Nil	Nil	..	1/8 — 1/4	1/8 — 1/4	1/9	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	27/32 — 27/32	27/32 — 27/32	16/6	15/3	..	5 19 5
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	97 —100	97 —100	..	..	..	4 10 0
$10,323,200	Mexico Trams Co., Common Stock	..	..	..	..	..	129½ —131½	128 —130	129	127½	—1½	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	5 %	..	96½ — 97½ xd	97½ — 98½	99½	97½	+1½	5 1 3
345,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	3/8 — 1/2 xd	3/8 — 1/2	..	..	..	..
345,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	3/4 — 7/8	3/4 — 7/8	..	..	..	6 17 11
345,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	82 — 85	82 — 85	..	..	..	5 3 6
37,350	Telegraph Construction and Maintenance	12	15 %	17½%	15 %	17½%	32½ — 34½	32½ — 34½	34	33½	..	7 2 10
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100½ —102½	100½ —102½	..	..	..	3 18 1
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	5 %	..	100½ —102½	100½ —101½	101⅛	100⅜	..	4 18 6
2,800,000	Do. do. 4½% Bonds	..	..	..	4½%	4½%	89 — 91	89 — 91	89½	89⅛	..	4 18 11
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	38 — 40	38 — 40	38¾	..	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	10 %	5 %	Nil	3/8 — 5/8	1/2 — 5/8	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 116,001 to 141,666	5	..	6 %	6 %	8 %	1 1/2 — 2	1 1/2 — 1 3/4	..	..	— 1/4	8 11 5
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	60 — 70 xd	60 — 70 xd	..	..	..	5 14 4

ELECTRICITY SUPPLY COMPANIES.

30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 30,000	5	10%	10 %	10 %	10 %	7 3/8 — 7 7/8	7 1/4 — 7 3/4	..	..	— 1/8	6 9 0
2,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 7 1/2	7 — 7 1/4	..	..	..	4 13 4
400,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	98 —101 xd	98 —101 xd	..	..	..	3 19 8
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3 3/4 — 4 1/4	3 3/4 — 4 1/4	..	..	..	5 17 8
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4 1/4 — 4 3/8	4 1/4 — 4 3/8	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	8 1/4 — 4 3/8	8 1/4 — 4 3/8	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
49,496	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	3 7/8 — 4 1/8	3 7/8 — 4 1/8	..	..	..	5 9 1
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	101 —103	101 —103	102½	102	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	7 %	11 3/8 — 11 7/8	11 1/4 — 11 3/4	11 3/8	11 1/4	— 1/8	5 19 2
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 13	12 — 13	..	..	..	4 12 4
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	121 —125	121 —125	..	..	..	4 0 0
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	101 1/2	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	Nil	Nil	1 7/8 — 2	1 7/8 — 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2 3/8 — 2 1/2	2 3/8 — 2 1/2	..	..	..	7 13 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	94 — 96	94 — 96	..	..	..	5 4 2
40,000	County of London Electric Lighting, Ord. 1—4,000	10	5 %	5 %	5 %	5 %	7 3/8 — 8	7 3/8 — 8	7 13/16	..	..	6 5 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10 3/4 — 11 3/8	10 3/4 — 11 3/8	11 3/8	11 1/4	..	5 15 8
400,000	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	105 —108	105 —108	107 1/2	106	..	4 3 4
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	98 —101	98 —101	100 1/2	100 1/2	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	..	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	..	1 1/2 — 1 3/4	1 1/2 — 1 3/4	..	..	..	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	..	74 — 77	74 — 77	..	..	..	5 16 11
$8,150,000	Electrical Dev. Co. of Ontario, 6% 1st Mtg. Gold Bnds.	$500	..	..	5 %	5 %	82½ — 85½	82½ — 85½	84¼	..	..	5 17 0
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4 1/2 — 4 3/4	4 1/2 — 4 3/4	..	..	..	5 15 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	5 — 5 1/2	5 — 5 1/2	..	..	..	4 10 11
80,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
15,600	Hove, 1 to 15,000	5	9 %	8½%	8½%	8½%	7 — 7 1/2	7 — 7 1/2	7 3/8	..	..	5 13 4
$1,875,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	102 —104	102 —104	103 1/2	102 1/2	..	4 16 2
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	8 %	8 %	6 3/4 — 7 1/4	6 3/4 — 7 1/4	..	..	..	5 10 4
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94 1/2 — 96 1/2	94 1/2 — 96 1/2	..	..	..	4 2 11
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2½%	3 %	..	1 3/8 — 2	1 3/8 — 2	..	..	..	4 8 11
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	..	4 1/2 — 5 1/4	4 1/2 — 5 1/4	..	..	..	5 14 3
382,855	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½%	4½%	4 %	4 %	92 — 94	92 — 94	93 1/2	..	..	4 5 1
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8 %	6½%	5 %	5 %	3 3/4 — 4	3 3/4 — 4	77/6	72/6	..	6 5 0
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4 1/2 — 4 7/8	4 1/2 — 4 7/8	94/3	..	..	4 12 4
285,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	4 4 1
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83 — 86	83 — 86	86	..	..	4 1 5
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	..	84 1/2 — 85 1/2	85 — 86	85 3/8	..	+ 1/8	5 16 3
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	3½%	..	78 — 80	80 — 82	81	79 3/4	+ 1/8	4 5 4
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	103 —105	103 —105	104 3/4	104	..	6 13 4
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	89 3/4 — 90 1/2	90 — 91	91	89 1/4	+ 1/8	5 9 11
950,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	97 — 99	97 — 99	..	..	..	4 10 4
180,491	Newcastle-on-Tyne, 1 to 187,500	5	8 %	8 %	2½%	..	4 1/8 — 4 3/8	4 1/8 — 4 3/8	..	..	..	2 14 0
187,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	5 %	4 3/8 — 4 5/8	4 3/8 — 4 5/8	..	..	..	5 2 7
136,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,365	100	..	..	..	5 %	99 —101	99 —101	..	..	..	4 19 0
10,853	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	11 3/8 — 12 3/8	11 3/8 — 12 3/8	..	..	..	5 9 10
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	7 %	6 3/4 — 7	6 3/4 — 7	6 1/8	..	..	5 0 0
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 190,507	1	2½%	6 %	8 %	9 %	2 1/16 — 2 5/16	2 1/16 — 2 5/16	45/-	44/3	..	3 17 10
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 3/32 — 1 5/32	1 3/32 — 1 5/32	..	..	+ 1/16	4 19 0
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —105	103 —105	..	..	..	4 15 8
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10 %	8 1/2 — 8 3/4	8 1/2 — 8 3/4	8 1/4	..	— 1/8	5 15 11
20,000	Do. do. 7 % Pref. 20,001 to 40,000	5	7 %	7 %	7 %	7 %	6 3/4 — 7 1/8	6 3/4 — 7 1/8	7	..	..	4 14 11
150,000	Do. do. 8½ % Deb. Stock Red.	100	8½%	8½%	8½%	8½%	86 — 88	86 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1 1/2 — 2	1 1/2 — 2	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	8 %	4 %	5 %	5 %	2 1/2 — 3 1/2	2 1/2 — 3 1/2	..	..	..	6 9 0
180,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	101 —104	101 —104	..	..	..	3 16 11
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	1/2 — 3/4	1/2 — 3/4	..	..	..	5 0 0
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 — 1 1/8	1 — 1 1/8	..	..	..	6 4 5
294,592	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	1/2 — 1	1/2 — 1	..	..	..	20 0 0
80,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	2 — 2 1/2	2 — 2 1/2	..	..	..	10 0 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	79 — 81	79 — 81	81	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	..	5 %	..	3/8 — 7/8	3/8 — 7/8	..	..	..	5 14 3
100,00	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	8 — 8 1/2	8 — 8 1/2	8 7/16	8 1/2	+ 1/8	5 15 11
81,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	5 — 5 1/2	5 — 5 1/2	5 1/16	..	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 3½ per cent., June 2nd, 1910.

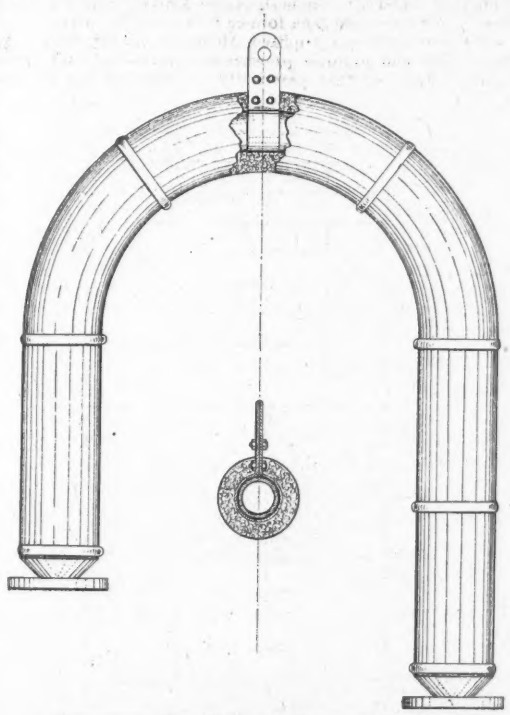
ON SLINGING PIPEWORK.

By S. LEES.

When handling pipework fitted with heat non-conducting insulation, considerable trouble is likely to be experienced if the sections or set pieces, particularly if very heavy, are slung without first removing the covering. And, if the latter operation is necessary, much valuable time may thereby be wasted, especially in the case of a plastic compo. covering.

With some forms of loose insulation as silicated cotton, fossil meal, magnesia, &c., which are usually encased in external metal sheathing, prior removal is imperative, to avoid damage, owing to the extreme mechanical weakness of this class of covering.

In order to obviate trouble of the kind above-mentioned and to facilitate handling, some manufacturers, notably engine builders, provide means for lifting in the form of cast



Permanent Pipe-Clip for Slinging Purposes.

or welded lugs suitably located and arranged to take eyebolts or shackles, so that slinging is straightforward and comparatively easy. Another method devised by the writer for use particularly on heavy distorted pieces is to employ stout iron or steel clips which are securely fitted and properly located as regards balance, to expedite handling in slinging.

The accompanying sketch, which is really self-explanatory, illustrates the method of attachment to an ordinary separator-to-engine bend, insulated with a loose non-conducting composition and encased externally with sheet metal.

The practice of rigging slings, &c., over valves and other operating mechanism cannot be too strongly condemned, and caution should be exercised in taking advantage of existing pipe supporting devices, as the latter are often only intended to act as guides or for simply easing the weight off other appliances.

Canada.—An American Consul at Charlottetown reporting home says that the imports by Canada of electrical goods in the fiscal year 1909 amounted to $2,128.241. "Nearly all of these, or $1,992,110 worth, came from the United States. This trade rose rapidly from $871,312 in 1900 to $3,578,288 in 1906; since that year there has been a steady decline. *This is due to the establishment of American branch factories in the Dominion.* In the province of Prince Edward Island the installation of electric lights is becoming general, and there is a growing market for electric light fixtures. Those of brass finish, medium in price, are mostly in demand."

CO-OPERATION.

By "INTERESTED."

Those electricity supply undertakings which are situated within the metropolitan area have certain powers for co-operation by "linking-up," although, up to the present, little has been done in that direction.

Now, I should like to suggest that co-operation in another way would prove a success. I refer to coal supplies. What is there to stop a number of the riverside undertakings joining hands, and between them purchasing a steamer capable of coming up the river under bridges? By this means coal could be brought from the North, or from Wales direct, right up to the wharves, or nearest convenient wharves, of the stations situated on or near the river-bank, without a second or third handling. A suitable ship with a carrying capacity of about 1,000 tons could get up as far as Hammersmith, or even Barnes, and by working in deliveries one with another, a regular supply could be ensured to each party irrespective of the class of fuel used.

The capital cost would not be excessive when apportioned over a number of stations. Besides the ship, a large pontoon with two cranes thereon would be required, as well as a good size lighter or two for making journeys to and from the pontoon and shore, as in some cases, the ship would have to be moored out in the stream owing to lack of water alongside the wharves. The total capital cost would not exceed about £20,000, and, by buying at the pit mouth and shipping direct from the nearest port to alongside the works, this sum would be easily saved in two years' working.

Gas companies are doing this and making thousands of pounds over the price they would otherwise have had to pay for taking supplies by barge. Why not electricity works? I was going to mention Borough Councils, but it is no use thinking of those bodies making a move until someone else comes along and shows the way.

Anyhow, the subject is well worth consideration now.

STREET LIGHTING: ELECTRICITY v. GAS.

The rapid displacement of gas by electricity for street lighting naturally disturbs the repose of the gas interests. In the last quarterly issue of *Gas Progress*, which is widely circulated throughout the country, with the object of counteracting the inevitable advance of electricity to its ultimate goal as the survivor of the fittest, we find under the heading of "The Lights of London," a reference to a visit to the Continent by a deputation of members of the City of London Corporation, to investigate the system of street lighting, *inter alia*—at Berlin—the article states that the deputation have issued a report on their investigations, and in this prominence is given to the fact that in the streets of Berlin electric lamps are being superseded as rapidly as possible by high-pressure gas lamps, and that it is intended that the whole of the city shall be lighted by gas. We have made inquiries into the matter, and are informed that among the electrical world of Berlin nothing is known of this important decision of the municipality. Our informant writes:—

"With regard to the enclosed extract from *Gas Progress*, I have to inform you that I was in Berlin last week and made inquiries as to the truth of the statement from several electrical engineers of the highest standing.

"They all concurred in saying that they had no knowledge of any such intention on the part of the City Council; but, said they, it would not surprise us to hear of it at any time, because the gas works belong to the City and the electric works to a company."

It is interesting in connection with the change-over of a further 2,096 public lamps in Marylebone from gas to electricity, to find that the chairman of the Gas Light and Coke Co. complains of this fact as "entirely due to the preferential treatment of electricity by interested local authorities."

So that the change of systems in Berlin and Marylebone is

supposed to be the natural result of the municipal trading in the one case in gas, and in the other in electricity supply, and we may point out that in other places where both the gas and electricity undertakings belong to the local authorities the competition must be somewhat complicated.

The Corporation of the City of London ought not to have much difficulty in dealing with any such recommendation as that alleged, for they possess ample testimony from actual experience of the great advantage of electricity for street lighting over the high-pressure gas lamps.

Some three or four years ago a test was made at the Mansion House, when three electric arc lamps of the flame type were installed above five of the new high-pressure gas lamps, the difference in the amount of light being such as to make the latter look quite ashamed of themselves.

The relative cost was enormously in favour of the electricity, besides the candle-power of the three flame arcs being 3,951, against 1,220 by the five gas burners! The cost of the electric lamps was £12 10s. each, and that of the gas burners £15, or £37 10s. against £75.

With such a result as this, it is not to be wondered at that the five high-pressure gas lamps were discarded and the three flame arcs have continued to this day to illuminate the front of the Lord Mayor's official residence.

In face of such facts, it is amusing to read the statements of the gas companies as to the relative cost of incandescent gas and electric lighting, and the persevering efforts, by publications of all kinds, to persuade the public to continue the use of gas.

We have before us a packet containing *eight* pamphlets and leaflets recently sent out by the South Suburban Gas Co., in one envelope, to inhabitants of the district they cover, and we commend their enterprise, in a losing cause, to the electrical companies whose publication arrangements are very far from perfect, and who possess all the advantages of dealing in the cheapest and best system.

One of the statements of the South Suburban Gas Co. in their circular on the maintenance of incandescent gas lighting, is that "the cost of gas, as supplied by the company, when burned in incandescent burners, is less than one-tenth of the cost of electricity when sold at 6d. per unit for an equal amount of light."

An assertion of this kind should be met at once by the publication departments of the electric supply undertakers working in the same district, *if any such publicity arrangements exist*, but unfortunately this very essential commercial branch of the business is, with a few notable exceptions, conspicuous by its absence.

In considering the relative cost of street lighting by electricity and gas, under the most up-to-date systems, one important element in the calculations must not be forgotten, viz., *the respective lives of the electric lamp and gas mantles and the maintenance of their candle-power.*

In one of the towns lighted throughout by electricity in North London, a recent report shows that 12 Osram lamps used in street lighting had an average life of 2,130 hours, and in a sub-station, although considerably over-run nightly, a similar type of metallic-filament lamp had lasted over 5,000 hours.

In the case of these lamps there is practically no deterioration in the candle-power, but gas mantles, assuming that they start when new, with 60 C.P., rapidly lose their illuminating power, and at the end of a comparatively short life, require renewal in attempts to secure the supposed standard of illumination.

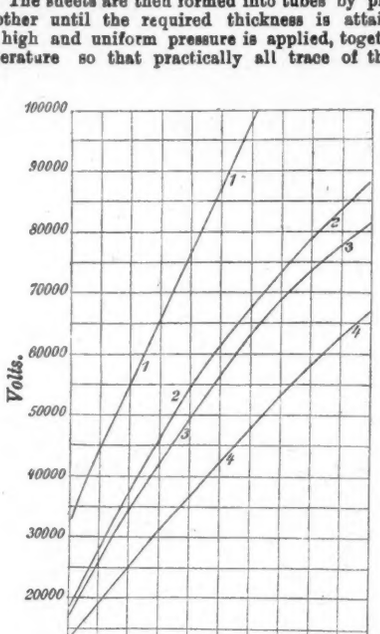
The calculation of the South Suburban Gas Co. is based, as we have shown above, on a charge for electricity of 6d. per unit, but this is a far higher price than is actually paid by the consumers in the district, either for private or public lighting. The average price obtained for private lighting by the South Metropolitan Electric Light and Power Co. is 2·88d. per unit, and throughout the metropolitan area no such price as 6d. is charged either by companies or local authorities; in fact, for street lighting it is nearer one-third of that figure, indeed, in some places a penny and under, such as at Brompton, Kensington and St. James's.

It is difficult to understand any London municipality reverting to gas for street lighting, after experiencing the improvement in every respect of electricity. Whatever the action of Berlin may be, we commend to them the Latin quotation, *Non fumum ex fulgore, sed ex fumo dare lucem.*

MICA TUBES WITHOUT PAPER.

Most insulators deteriorate with temperature rise and have an appreciably lower breakdown voltage at the working temperatures reached in practice than at the ordinary air temperature. Practically the only material, in fact, with which this effect is not noticeable is mica. Mica is consequently largely used in machine insulation, in spite of the fact that its brittleness makes it difficult to form into tubes and similar shapes. This difficulty, and the fact that large sheets of mica are expensive, have led to the widespread manufacture of micanite tubes, in which a considerable proportion of paper or other supporting and binding material is embodied. Paper is especially necessary if uniformity of thickness and absence of surface roughnesses are to be ensured. The purity of the material is impaired in this way, and a given thickness of micanite naturally has a lower breakdown voltage than an equal thickness of mica. The mechanical strength of the material is also reduced by the presence of the paper, because it encourages the presence of air bubbles. On this account, Messrs. Meirowsky and Co. have recently experimented with micanite tubes containing no paper and very little binding material, and have effected a considerable improvement.

The tubes are made up of thin sheets composed of mica flakes and a binding material. These sheets are kept of exactly uniform thickness. The sheets are then formed into tubes by pressing one over the other until the required thickness is attained. An extremely high and uniform pressure is applied, together with a high temperature so that practically all trace of the binding



BREAKDOWN PRESSURES OF MICA TUBES.

material introduced at first is expelled again, and the resulting material is practically pure mica. The slight remainder of foreign matter is finally removed by long-continued heating. Numbers of such tubes have been tested by filling up the inside with iron rods projecting at both ends and coating the outside with tinfoil kept well away from the edges.

A high-voltage supply from a transformer was then applied between the coatings and the rods for one or two hours, until a steady temperature was attained, as shown by a thermometer held on the outside and having its bulb wrapped round with tinfoil and covered by a small piece of felt.

Four tubes of each thickness from 1 mm. to 5 mm. were tested for one hour at a voltage at which at least one of the tubes broke down in each case. The temperatures reached and the breakdown voltages used were as follows:—

Thickness of tube.	Volts.	Temperature at end of one hour test.	Remarks.
1 mm.	18,000	110—115° C.	One tube broke down after 10 min. and at a temperature of 110° C.
1½ mm.	30,000	162—178° C.	1 tube after 15 min. at 200° C.
2 mm.	38,000	235—290° C.	1 tube after 25 min. at 235° C.
2·5 mm.	48,000	190—225° C.	1 tube after 25 min. at 190° C.
3 mm.	58,000	195—225° C.	1 tube after 30 min. at 195° C.
4 mm.	63,000	210—230° C.	1 tube after 20 min. at 220° C.
5 mm.	70,000	210—280° C.	1 tube after 50 min. at 280° C.

It will be seen that temperatures as high as 150°—200° C. were endured by the tubes for long periods at voltage stresses of the high value of 15,000—18,000 volts per mm. Such high temperatures are at present not permissible in view of the use of cotton-covered wire, but it may be of future interest to know of an insulator capable of withstanding them. In any case voltage stresses of 7,500 volts per mm. can be safely employed with this material. For the sake of comparison some curves of breakdown voltage are given on page 970. Curve 1 shows the results attained with the new pure mica tubes at a temperature of 80° C. Curve 2 applies to ordinary micanite tubes at the same temperature. Curve 3 is for "Pertinax" tubes (made of a mixture of paper and resin) when cold, and curve 4 is for "Pertinax" tubes at 80° C. Curves 1 and 2 would be practically unchanged if taken cold.—*E.T.Z.*

THE ELECTRICAL TRADE OF INDIA.

The continued preponderance of the United Kingdom in the electrical trade of India is again illustrated by the statistical tables contained in the recently issued Blue Book on the trade of British India with British possessions and foreign countries between 1904-5 and 1908-9 inclusive. In the case of electrical machinery, the United States have now supplanted Belgium in the second position in assisting to meet the requirements of India, but the former country has been ousted by Germany from the second place in electrical instruments and apparatus, although the latter's share still has a downward tendency. The following are details of the movements in various classes during the past three years:—

Electrical Machinery.

	1906-7.	1907-8.	1908-9.
United Kingdom	£154,265	£155,230	£202,846
Belgium	6,009	16,087	2,526
Germany	6,216	6,276	4,265
Italy	2,847	3,783	4,547
United States	8,733	14,415	19,496
Other countries	2,202	2,296	2,795
Total	£180,272	£198,087	£236,475

Electrical Instruments, Apparatus and Appliances.

United Kingdom	£296,612	£295,306	£281,679
Austria-Hungary	329	2,978	1,290
Belgium	16,934	6,391	4,171
Germany	28,059	13,024	11,174
United States	27,782	7,482	5,302
Other countries	2,143	2,009	1,836
Total	£371,859	£327,190	£305,452

Scientific, Philosophical and other Apparatus.

United Kingdom	£85,083	£84,053	£101,127
Austria-Hungary	403	560	500
Belgium	3,058	2,284	5,363
France	1,531	816	2,228
Germany	11,716	3,050	6,785
United States	3,612	3,754	3,732
Other countries	2,222	1,542	1,806
Total	£107,625	£96,059	£121,561

Steam Engines and Parts.

United Kingdom	£805,136	£809,532	£642,519
Belgium	8,748	18,225	8,301
Germany	1,151	6,206	2,377
United States	8,227	4,690	14,135
Ceylon	3,553	2,203	4,454
Other countries	2,719	692	1,043
Total	£829,534	£841,548	£672,829

Mining Machinery.

United Kingdom	£39,665	£48,493	£78,903
Belgium	311	2,740	115
Other countries	1,434	479	3,384
Total	£41,410	£51,712	£82,402

Railway Carriages and Trucks.

United Kingdom	£965,702	£2,061,582	£2,570,344
Belgium	38,138	28,508	48,640
Germany	2,080	6,407	1,162
Other countries	4,355	1,654	3,176
Total	£1,010,275	£2,098,151	£2,623,322

Rails and Fishplates.

United Kingdom	£506,636	£537,274	£714,838
Austria-Hungary	—	—	15,234
Belgium	27,881	17,163	22,325
Russia	—	26,608	—
Other countries	228	12	209
Total	£584,745	£581,057	£752,60

Calcium Carbide.

	1906-7.	1907-8.	1908-9.
Belgium	£916	£987	£529
Germany	5,255	6,388	10,261
Other countries	1,333	576	125
Total	£7,504	£7,951	£10,915

Manufactures of Caoutchouc.

United Kingdom	£50,240	£60,483	£58,393
Austria-Hungary	1,207	822	1,302
Germany	12,646	10,618	14,795
Other countries	2,892	3,622	2,565
Total	£66,985	£75,545	£77,055

The Blue Book records private imports of materials for the construction of telegraphs of the value of £8,708 in 1908-9, as compared with £1,947 and £9,898 in 1907-8 and 1906-7 respectively. In addition, the imports of telegraph materials for the account of the Government, the imports of which are all cited separately, represented £63,398 in 1908-9, as contrasted with £104,825 in 1907-8 and £186,072 in 1906-7, and in each year nearly the whole quantity was procured from the United Kingdom, the total obtained from other countries having scarcely reached £4,000 in the three years combined. The United Kingdom was almost wholly the source of the Government imports of instruments and apparatus, the value of which is returned at £135,690 in 1908-9, £115,985 in 1907-8, and £94,321 in 1906-7. The Blue Book does not contain any separate indication of imports of tramcars, which are apparently included under the heading of railway carriages and trucks.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Standard Tinfoil-Mica Condenser.

In the latest pattern of Mr. J. Rymer-Jones's patent standard condenser,* a large number of separate elements, each consisting of a mica sheet with a metal foil on both sides, are arranged, like the spokes of a wheel, round two central slotted rings of insulating material. The foils are so arranged that the negative foil of one element (say A) faces and is in metallic connection, through its lug, with the negative foil of the element next to it on the one side; and, similarly, the positive foil of the element A faces and is in metallic

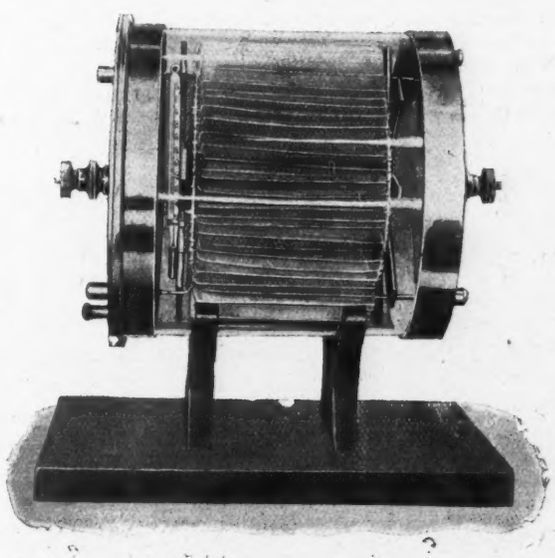


Fig. 1.—Rymer-Jones Patent Condenser.

connection with the positive foil of the element next to it on the other side, as shown in fig. 2, p. 972. Therefore, since positive faces positive, and negative faces negative, of the foil-mica elements, any alteration in the distance, or even contact, between their adjacent surfaces, in no way affects the amount of charge held by them.

Another important advantage in this form of condenser is that, inasmuch as the elements are not subjected to lateral pressure—as are the condenser plates ordinarily built up into a solid block and confined between unyielding clamps—expansion or contraction

* See Electrical Review, June 30th, 1905, p. 1043.

under considerable heat or cold does not tend to develop a weakness due to the possible presence of a particle of grit; and, as no paraffin wax is employed, the capacity on this account remains more constant under a tropically-high temperature. All these elements are, in fact, during construction heated to 140° F. for a long period without damage.

Moreover, the large surface offered by the condenser elements quickly takes up the temperature of the air inside the case, so that a coefficient corresponding to the actual temperature of the condenser may be applied. For this purpose there is a thermometer inside the case, which can be easily read through the air-tight glass cylinder in which the condenser is mounted. Each of the two brass caps, into which the ends of the glass cylinder are cemented, has a small brass tube fitted, through which dry air may be drawn to dry the interior of the condenser case. For this purpose a short piece of rubber tubing connects the brass tube on one side to an air-pump, while another short length of rubber tubing connects the other brass tube with a glass vessel containing chloride of calcium or sulphuric acid or pentoxide of phosphorus, in passing through which the air is dried before entering the condenser case, after which the brass tubes are closed by air-tight plugs. As an alternative method of drying, the brass cap at one end may be unscrewed, and the condenser taken out and warmed in front of the fire thoroughly to dry its surface and the interior of the case.

As, however, every possible precaution is taken to make the case air-tight, it will be a very long time before sufficient moist air can find its way in to decrease the insulation resistance of the condenser, so that the drying process need only be repeated if it is required to increase the surface insulation resistance as much as is possible.

Another special advantage is that, should one of the elements show signs of weakness, it is easily replaced by a good one; or if an extra mica-foil plate is not available, the weak element and the one next to it (it is unimportant on which side) can be cut out simply by unsoldering the fine wires connecting their tinfoils to the + and − circular wires, to which all the positive and negative foils are soldered respectively. If there is no other standard available with which to compare it, the capacity may be taken as very approximately $\frac{N-n}{N}$ of the original standardised capacity marked on the case; N being the original number of elements, and n the number of elements removed.

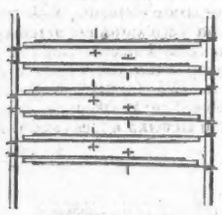


Fig. 2.—Construction of Elements, Rymer-Jones Condenser.

These condensers are made at the Silvertown Telegraph Works, where they have been tried for some years and found to give a very constant capacity when tested with steady currents.

Insulating Shield for Lampholder.

Compliance with Rule 13 of the new Home Office Regulations requires that, in certain positions, metal lampholders shall either

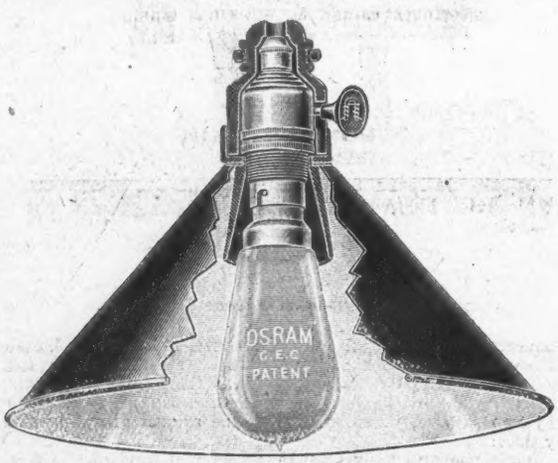


Fig. 3.—Section of Coates Insulating Shield.

be earthed, or entirely enclosed in insulating material. The former alternative is inconvenient in any event, but especially in the case of an existing installation, and a device just brought out by the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., is intended to carry out the latter in such a way as to comply with the Regulations in every respect, without any rewiring.

As shown in the accompanying section, it consists of an insulating shield constructed entirely of fire-proof material it completely

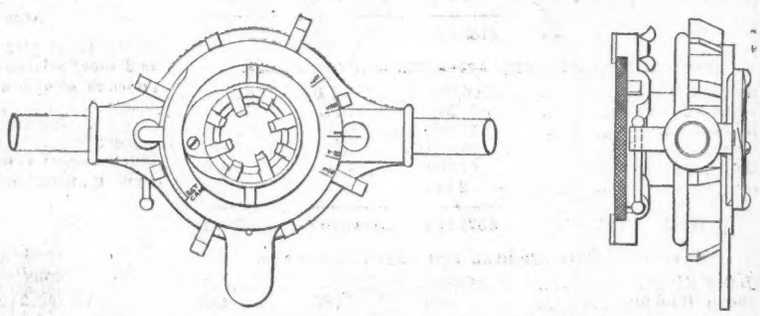
Fig. 4.—Lampholder Enclosed in Coates Shield.

encloses all the metal parts of the lampholder, and can be applied without unwiring the latter. Further, the shade is also insulated, so that enamelled iron shades can be employed.

The operation of fitting the shield in position, we are informed, takes only a few seconds. By its means an installation can be brought into conformity with the requirements with the minimum expenditure of time and money.

Universal Die Stock for Conduit.

The accompanying figures show plan and end views of a small die stock, complete within itself, for standard electric size conduits. This will cut threads of ½ in., ⅝ in., ¾ in., ⅞ in. and 1 in. conduit without changing dies. It is provided with two sets of dies; one



Figs. 5 and 6.—Plan and End View of Universal Die Stock.

set cuts ½ in. and ⅝ in., the other ¾ in., ⅞ in. and 1 in., and both sets are operated by a single cam, so constructed as to withdraw one set of chasers while the other set is being adjusted—one set cannot get in the way of the other. The dies are held where set by a lock of new construction, which cannot slip. The end view shows also a device which centres the pipe; the guides are made of hardened tool steel to prevent wear. The tool is being put on the market by Messrs. Drake & Gorham, Ltd., of 66, Victoria Street, S.W.

Portable Instruments for D.C. and A.C.

Messrs. Nalder Bros. & Thompson, Ltd., of 34, Queen Street, London, E.C., have recently placed upon the market a complete line of portable and portable standard instruments, suitable for continuous and alternating currents. These instruments are of the dynamometer type, provided with air damping to render them dead beat, and have been carefully designed with a view to securing great accuracy.

The instruments of this type, comprising ammeters, voltmeters and wattmeters, are fitted in polished wood cases with strap handle, lock and key, the case being protected with rubber feet. The pointers are of the edgewise pattern, with anti-parallax mirrors, and the scales are very finely and accurately divided, so that observations can be made to a considerable degree of accuracy. A zero adjustment is provided. The portable standard voltmeter illustrated (fig. 7, p. 973) has ranges of 15, 150 and 600 volts. The ammeters are wound self-contained for currents up to 50 amps., beyond which portable series transformers are supplied.

The wattmeters are self-contained for pressures up to 300 volts, and currents up to 50 amperes. For pressures from 300 to 650 volts, an external resistance box is used, and for currents above 50 amperes, portable current transformers are supplied. For high-pressure circuits, pressure and current transformers are employed. The portable standard wattmeter is very similar in appearance to the instrument shown in fig. 7.

Another instrument suitable for D.C. and A.C., and constructed on the dynamometer principle, is the lamp-testing wattmeter shown in fig. 8. This instrument is arranged for two voltages, say 100 and 200 volts, with a two-way switch key; when this is placed on

the contact corresponding to the voltage and depressed, the instrument reads directly the actual watts consumed. The instrument is fitted in a polished wood case with strap handle, with the lamp-

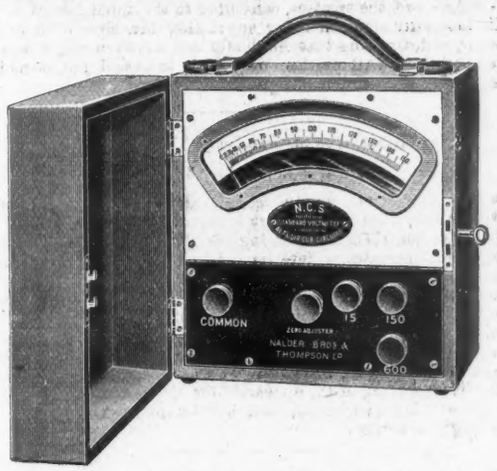


FIG. 7.—PORTABLE STANDARD VOLTMETER.

holder and fuse on one side, and is provided with a length of flexible wire fitted to a plug, which can be inserted into the standard lampholders.

The dynamometer type of dead-beat instrument is also made in a switchboard pattern case, black enamelled with nickel or copper finish.

Messrs. Nalder Bros. & Thompson make a strong point of the fact that they use only English material, and strictly exclude

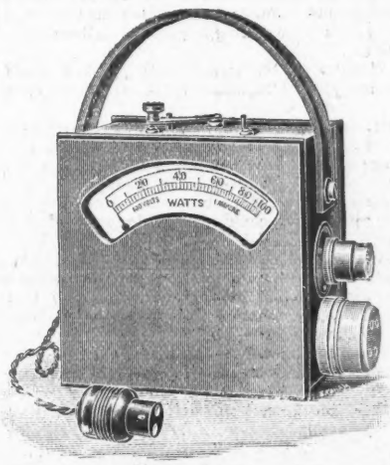


FIG. 8.—PORTABLE LAMP-TESTING WATTMETER.

everything of foreign origin, excepting, of course, such material as is not obtainable in this country.

Electric Lamp-Locking Clip.

A simple device called the "Lamlok" clip has been invented by MR. C. H. JEFFCOAT, of 2, Marchmont Court, Addison Gardens, W., for the purpose of securing metal-filament lamps against theft. It consists of a small strip of metal, shown shaded in the figure; when the lamp is in place, the corner of the metal is turned up at

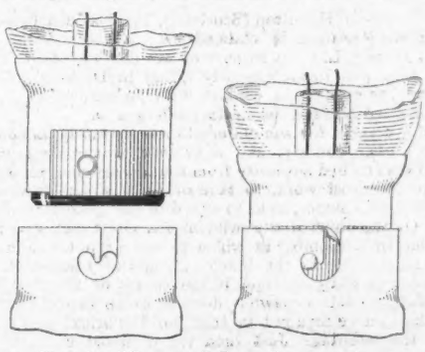


FIG. 9.—"LAMLOK" LAMP-LOCKING CLIP.

the slit as shown in the right-hand view, and prevents the lamp from being turned in the holder. A thief would not notice the clip, and would not tarry to investigate the matter, but when the owner wishes to remove the lamp he can easily turn the metal down again.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electricity Works Statistics.

I should be glad if a few of your readers would supply information on the following points. Providing I obtain sufficient data to supplement my own, I shall be enabled to complete certain analyses of the same, the results of which will be submitted for publication in the ELECTRICAL REVIEW. The information I desire is :—

(*a*) Total KW. capacity of station or feeder.

(*b*) KW. installed on station or feeder for lighting, power, traction, heating, cooking, &c.

(*c*) Load on station or feeder in following cases (average demand required) :—

1. Morning load (11 a.m., say) light day in January.
   " " " " June.
2. Afternoon load (4 p.m., say) dark day in January.
   " " " " warm weather (quote month if possible).
3. Evening load, 8 p.m. in January.
   " 9 p.m. in June.
4. Load between 2 a.m. and 3 a.m. in January and in June.

K. Trobridge.

London, *June 4th*, 1910.

The Whitehaven Colliery Disaster.

While agreeing with the views expressed by your correspondent "Maque," viz., that mine owners should be compelled by the Board of Trade to install a system of mine telephones, one would infer from his letter that these apparatus are not used in this country, but only in South Africa and Australia.

For the last few years we have made a speciality of watertight mining telephones, and judging from orders received from electrical engineers for these apparatus for erection in Britain, it would seem as if the majority of mines in Britain must use these telephones.

James McMillan & Co.

London, W.C., *May 28th*, 1910.

Flame Arc Lamps—Carbon Deposit.

The writer would be glad of the experience of your readers relative to the above. The trouble arises from the fumes given off from a flame arc lamp, which is fixed inside a shop window. The deposit given off from the carbons has adhered to the window glass, and, despite the use of various acids and alkalis, it is impossible to remove this deposit. If any of your readers have had a similar experience, which they have overcome, the writer would be glad to know the means used to secure this result.

Inquirer.

The Prevention of Rust.

The writer has been interested recently in the cause and effects of rusting on steel overhead tramway poles. The depreciation in strength of steel work due to rusting is probably more serious than is generally thought. The chemical composition of rust, of course, varies, but the under layer usually consists of black ferric oxide. The top layer is a complex substance, probably being ferric oxide combined more or less with carbonate and chloride of iron ($Fe_2 C_3 O_6$ and $Fe_2 Cl_6$) which gives it its bright red colour. The first action of the water, salt and acid impregnated atmosphere on clean steel may be somewhat as follows :—First, the formation of carbonate and chloride of iron (especially near the sea), these in turn being broken up, in the presence

of nascent hydrogen, or possibly by the action of small voltaic electric currents, into a ferric oxide ($Fe_2O_3 3H_2O$), liberating acids which, being in intimate contact with the metal, are free to continue their pernicious work. This recurrent action differentiates iron from such metals as copper and zinc, which, when exposed to the atmosphere, become covered with an incrustation which protects the metal from any further wasting.

If we estimate the amount of wasting of iron structures by rusting, assuming that the composition of the rust is given by the formula $Fe_2O_3 3H_2O$, and taking the atomic weights of iron and oxygen as 56 and 16 respectively, we arrive at the somewhat disturbing fact that 14 oz. of rust represent a wastage of 10 oz. of iron. I think that the methods to be adopted to prevent rusting of new work and the further rusting of old work are a subject worthy of ventilation in your columns.

A. J. Bousfield.

Northdown, *June 4th*, 1910.

The Institution of Mining Electrical Engineers.

At the inaugural meeting held at the Midland Hotel, Manchester, a very lengthy discussion took place as to the title of the new body. The title "Institute of Mining Electrical Engineers" had been unconsciously and naturally adopted as a matter of fact, and I am of opinion the matter would have rested there, but some members of the Institution of Electrical Engineers, fearing the new body would shine with a lustre greater than their own, sent representations to the I.M.E.E. that they must not call themselves so.

I must say the attitude taken by the I.E.E. towards the new body is by no means dignified.

I understand the outcome of this attitude is that the Council of the I.M.E.E. have resolved to accept the conditions so imperiously laid down by the I.E.E. and to alter the title. My opinion is that the matter of principle here involved is so important that an opportunity should be given the general body of members (I understand there are about 600) to decide, by ballot if necessary, whether they are willing to accept the conditions laid down by the I.E.E.

A Unit.

LEGAL.

Sunderland District Electric Tramways, Ltd.

In the Chancery Division, on June 2nd, before Mr. Justice Swinfen Eady, a motion was heard in a debenture-holder's action—Capes *v.* The Sunderland District Electric Tramways, Ltd.—for the appointment of Mr. Chas. Eves, chartered accountant, as receiver of the property of the company charged by the first mortgage debentures.

Mr. Micklem, K.C., appeared for the plaintiff, and said the company was formed to construct and work a tramway from Houghton-le-Spring to Sunderland. The trustees for the debenture-holders were the Debenture Securities Investment Co., and they, together with the second debenture-holders, were also defendants to the action. There were £160,000 debentures issued and outstanding, and £20,000 second debentures. The company had been carrying on business for the last eight years, but always at a loss. No interest had been paid on the preference or the ordinary shares, there being some £90,000 of the former class, and £74,990 of the second class. Things had now arrived at such a stage that everyone connected with the company recognised that there must be some form of reconstruction, and special meetings of the debenture-holders and the shareholders had been called.

His Lordship: Do you mean that the company does not even pay working expenses?

Counsel said that having paid interest on the borrowed money there had always been a deficit. A meeting of the debenture-holders and the shareholders was convened on May 19th, 1910, and the position of the company was then carefully laid before them by the chairman. It was indicated that there would not be sufficient money to pay the debenture-holders' interest which became due on July 1st.

In answer to his Lordship, Counsel said that there was no interest in arrear at the present time, but it was admitted that the debenture-holders' interest could not be met on July 1st. Under these circumstances he moved, on behalf of Mr. Capes, who, it was true, only held one debenture, but who was supported by a large number of debenture-holders, for the appointment of a receiver and manager.

His Lordship: There is no petition to wind up?—Counsel: Oh, no.

His Lordship: It is a limited company?—Counsel said it was a company formed to take over the powers of a previous company and work them.

Counsel for the tramway company, and for the second debenture-holders and the trustees, consented to the appointment.

His Lordship made an order appointing Mr. Eves receiver and manager, and directing that he should not act as manager beyond November 2nd. All parties consenting, the usual judgment in a debenture-holder's action was given.

Osram Lamp Works, Ltd., *v.* G. M. Boddy & Co.

Electric Lamp Patent Case.

This action was before Mr. Justice Parker in the Chancery Division on Friday last, upon interlocutory motion.

Mr. Walter, K.C., representing the plaintiffs, said that he was instructed to move for an interim injunction to restrain an alleged infringement of patent, but the defendants had raised the defence of non-infringement and invalidity, and he agreed it was not a case that could be usefully gone into on interlocutory motion. The defendants had undertaken to keep an account, and on that undertaking he was willing that there should be no order on the motion, except that the costs of the motion should be costs in the action.

Mr. T. Terrell, K.C., appeared for the defendants, and gave the undertaking mentioned, and his Lordship made an order accordingly as agreed.

Price Bros. *v.* Cuban Telephone Co., Ltd., and Others.

In the Chancery Division Mr. Justice Parker had before him a motion by the plaintiffs in this action for an interim injunction to restrain the second defendants, Messrs. Chaplin, Milne, Grenfell and Co., Ltd., from paying over to the first-named defendant, the Telephone Co, the sum of £3,864 now in their hands.

Mr. Mark Romer who, with Mr. Howard Wright, appeared in support of the motion, said that the sum in question was paid to Chaplin, Milne, Grenfell & Co., by the plaintiffs in payment for 5 per cent. first mortgage bonds issued by the Telephone Co. Counsel for the second defendants said they had no wish to part with the money, and were willing to give an undertaking until the trial of the action.

Mr. A. G. Wright, for the Telephone Co., said they had no wish to retain the money, but allegations had been made which he desired to answer.

Mr Romer: If the defendants were willing to put an end to the matter now, he would willingly withdraw all aspersions.

Mr. Wright said that he could not consent to a final order now as there were others interested. He would, however, give an undertaking until the trial if the aspersions were withdrawn.

Mr. Romer said that he could not withdraw them at this stage if the matter was to go to trial.

His Lordship suggested that the defendants should give the undertakings proposed until the trial "not admitting the allegations on the plaintiffs' affidavits," and that was acceded to.

Mr. Romer mentioned that there were two other similar actions pending in which no steps had been taken, pending the result of this motion, by other plaintiffs against the same defendants.

Defendants expressed their willingness to have those dealt with in a similar way, and upon the undertakings being given no order was made upon the motion.

British Electric Traction Co. *v.* Dudley Corporation.

The arbitration proceedings regarding what price should be paid for electric current by the company were resumed last Friday at the Surveyors' Institute, London, before Mr. W. H. Patchell. Mr. Hutchinson, K.C., represented the company, and Mr. Honoratus Lloyd, K.C., represented the Corporation. Mr. J. Fells, accountant, gave technical evidence on behalf of the company as to the basis upon which the price per unit of current was to be fixed.

Compensation Claimed for Colliery Fatality.

Sheriff Thomson, Hamilton (Scotland), has just concluded proof in which compensation is claimed by relatives from Messrs. Archibald Russell, Ltd., in respect of the death of John Wallace, a miner, who was instantaneously killed in Dechmont Colliery, Cambuslang, by coming in contact with an electric cable in the underground workings of the colliery referred to.

The chief witness for the claimants was David Wallace, night oversman at the colliery, and a brother of the deceased. He explained that he had authority from the management if there was a pressure of oncost work, to take ordinary miners from the coal face to render assistance, so as to expedite the general working of the pit. On the night of the accident the oncost men were making excavations in a chamber in which it was proposed to install an electric motor. Due to the blasting, a mortar board used by the bricklayers was badly damaged in the course of the shift, and he (David Wallace) felt somewhat flurried, as he feared they would not get the damage repaired in time for the bricklayers resuming work in the morning. Just then the deceased came to the pit bottom, and complained that he had been doing very badly at the coal face owing to the unavoidable absence of his neighbour. Witness then suggested that he might fill up the time for the remainder of the shift by removing two hutches of sand and a water chest from the engine seat and by lending a hand at the repairing of the mortar board. Three electric lights were fitted up in the chamber

but only one was lit. Two of the terminals were thus exposed, while a cable was coiled up and hung on a prop close to the engine seat. While the hutches of sand were being slewed on an iron plate, witness heard his brother cry "Oh, Davie, Davie!" Instinctively believing that the cable was to blame for the accident, witness took off his cap and pulled the coil down from the prop. His brother was almost instantaneously killed. The only theory he could put forward as to the cause of the fatality was that the deceased, while removing the hutches, had come in contact with a live wire.

PROF. JOHN GLAISTER, Glasgow University, said he had seen a piece of cable which was used in Dechmont Colliery on the night of the accident, and since the wires were exposed, he thought its condition was such as to cause a shock to any man coming in contact with it. He was aware that the chamber was heated, and it was an established fact in electrical science that the resistance of the body was much less with sweated hands than if the hands were dry. He knew cases where a similar voltage to what they had in the pit that night—namely, 230 volts—had been sufficient to bring about a fatal termination.

ALEXANDER MATHIE, Cambuslang, stated that he was the electrician in charge of the electric plant in No. 1 Dechmont Colliery. On the day previous to the accident he removed two of the three arc lamps, and he left the terminals exposed. The cable was coiled up on a prop about 4½ ft. from the ground. The distance of that prop from the iron plate where deceased was working with the hutches, would be from 2 to 3 ft. He quite conceded that a person coming in contact with a piece of cable in which the wires were exposed would receive a shock, and the current passing through one of the wires was at 230 volts. He was not qualified to say whether that voltage would cause death to a man who was perspiring freely on an iron plate, because, as a matter of fact, he had himself received a higher voltage than that, and he was still alive.

Generally speaking, the case for the defendants was that deceased being a miner ought not to have been taken from the face to do such oncost work as removing hutches of sand and a water chest; that there was no immediate urgency to justify the employment of the deceased at this work; and that, moreover, the whole task of shifting the hutches could have been completed in little more than 10 minutes.

The Sheriff deferred his judgment.

A STOKER'S CLAIM.

AT Carlisle County Court, on June 2nd, J. A. Carlyle, a stoker, claimed, under the Employers' Liability Act of 1880, three years' wages (£179 8s.) from the Corporation of Carlisle, as compensation for injuries sustained to his left hand during his employment at the Corporation electricity works, on November 17th, 1909. At an early stage in the proceedings a special defence was set up that the notice required under the Act had not been given. After lengthy hearing on the point, his HONOUR held that the action had not been properly brought. All along the Workmen's Compensation Act was intended, and no notice was given under the Employers' Liability Act. His HONOUR, however, consented to hear plaintiff's evidence in regard to his injury in view of the assessment of compensation.

PLAINTIFF described how he sustained the accident to his left hand, which got caught in the belting of a coal elevator.

DR. BARNES and DR. RAMSAY, who had examined plaintiff's hand, put in a joint report showing that the thumb was not likely to be of any further use without a surgical operation, and that the rest of the fingers of the left hand were more or less useless.

Cross-examination of all the witnesses by Mr. Collingwood was reserved, and his HONOUR ordered that the plaintiff should be examined by Dr. Roderick Maclaren as medical referee for the Court, and that Dr. Lediard should examine plaintiff on behalf of the Corporation.

The further hearing was adjourned until July 4th.

BABCOCK & WILCOX, LTD., *v.* WATER-TUBE BOILER & ENGINEERING CO., LTD., AND EDWIN DANKS & CO. (OLDBURY), LTD.

IN the Chancery Division on Monday, Mr. Justice Warrington had in his list of causes for trial, with witnesses, the action of Babcock and Wilcox, Ltd., *v.* The Water-Tube Boiler and Engineering Co., Ltd., and Edwin Danks & Co. (Oldbury), Ltd.

MR. COLEFAX (led by Mr. A. J. Walter, K.C.), in opening the case, made the following statement:—The position of the plaintiffs in this action is that which happens sometimes in cases of this kind. This action was started at rather an early date in the development of the matters complained of, and we feel that we are not at the present moment in a position to put the case of infringement before the Court. Upon our claim, therefore, our evidence is not in such a state as to justify us in occupying the time of the Court with that issue. There is, as your Lordship will see, a counterclaim for revocation.

His LORDSHIP: You submit to have judgment against you on the claim?

MR COLEFAX assented.

MR. BOUSFIELD, K.C., who appeared with Mr. Gray for the defendants, said the counterclaim in this case was put in as part of the defence to the action, and he thought his learned friend had rather put them at a disadvantage, which he ought not to have done, in not giving them some notice before they got there.

MR. WALTER said he only heard that morning.

MR. BOUSFIELD said he had not had time to consider the matter, but he would be averse to fighting these three patents in the face of the plaintiffs withdrawing their case. It was practically equivalent to a discontinuance of the action.

His LORDSHIP: It will be judgment on the claim for the defendants.

MR BOUSFIELD: Then it should be on such terms as your Lordship may think fit.

His LORDSHIP: I cannot compel the plaintiffs to open their case.

MR. BOUSFIELD said the whole thing now became material as regarded costs only.

His LORDSHIP: You have put in a counterclaim, and you must either open it or not.

MR BOUSFIELD said the plaintiffs brought an action for infringement, and they put a certain construction on the patent. Now they came to the Court, and said they agreed it was not an infringement. His Lordship would see that the counterclaim would never have been put in except for the allegation of the plaintiffs that upon the construction of the patent the defendants were infringers. Of course, it would be absurd to fight upon a construction which the plaintiffs now admitted was wrong. He (counsel) suggested that the defendants should be allowed to withdraw the counterclaim, and that each party should pay their own costs in respect thereof.

MR. WALTER said he thought it was an entirely unwarranted counterclaim.

His LORDSHIP said this was an action for infringement of certain letters patent. There were two actions, which were consolidated, and were against different defendants. Each of the defendants defended the action on what one might call the usual grounds, and among others, the ground that the letters patent were at the dates thereof, and still were, invalid. But besides defending the action on the ground that the patents were invalid, the defendants took what he ventured to think was rather a novel course. By way of counterclaim they repeated the allegation that the several patents were at the dates thereof, and still were invalid, and they stated that they had obtained the Attorney-General's leave, and they claimed for revocation of all and each of the letters patent, or such other order as the Court might think fit to make, and for costs of the counterclaim. In the other action it was put in a little different way, but in substance it was the same thing, and by way of counterclaim the defendants petitioned for revocation on the ground that the patents were invalid by reason of the matters set out in the particulars of objection. Now the action was called on at the trial, but it did not proceed to trial, because as soon as the action was called the plaintiffs stated that they submitted to judgment for the defendants, with the costs of the action. With regard to the counterclaim, the plaintiffs having submitted to judgment, the defendants did not open the counterclaim. They said the counterclaim was merely part of their defence, and they asked that in dismissing the action with costs the Court should make no order with regard to the costs of the counterclaim. His Lordship did not take that view at all. If a man chose to raise by way of counterclaim what was merely repetition of the defence to an action, he could not complain if the counterclaim was treated in the form in which he chose to put it, namely, as a counterclaim. The proper method of dealing with the matter was: the plaintiffs not asking for judgment in the action, and the defendants not asking for judgment on the counterclaim, the action must be dismissed with costs, and the counterclaim with costs.

CLYDE VALLEY ELECTRIC POWER CO. PROSECUTED.

A CASE was heard at Hamilton last week in reference to the dangers of electricity stations. Respondents were the Clyde Valley Electric Power Co., 53, Bothwell Street, Glasgow, and the charge was one of having, on March 3rd last, in their electric station at Cambuslang, had extra high-pressure conductors in a switchboard open from the front and from below, so that it was not adequately protected while dangerous work was being done by James Noble, electrician's labourer, Henderson Street, Paisley; also that they failed to make such switchboard dead, or to separate the section of such board by removal screens while repairs were being made by a person without technical knowledge or experience, in consequence of which James Noble was killed. An agent pleaded guilty on behalf of respondents and asked the Sheriff to dismiss the case with an admonition or the imposition of a nominal penalty. He explained that it was impossible to make the switchboard dead, as the current was running continuously. With regard to screens not having been provided, he stated it was the company's practice in the past to provide screens, and the responsibility for their use rested with the district engineer-in-charge. In this instance, the work was being carried through without the cognisance of the company. Continuing, the agent stated that, while Noble had served his apprenticeship as an iron turner, he had been in the employment of electric companies for some time, and had been employed at the erection of a sub-station at Cathcart. That station was completed in 1906 in compliance with the then existing regulations. Since then, however, the Home Secretary had prescribed further regulations for the better conduct of these places, and these regulations had only come into force on January 1st of this year. The Burgh Prosecutor stated that his instructions from the Home Office were in view of this being the first case in Scotland, to press for a penalty, which, while not severe, would yet be more than nominal. As to the regulations having only recently come into operation, he pointed out that they had been drawn up after long negotiation with the various industrial companies, including the Clyde Valley Co. The room in which the accident occurred was a small one—14 ft. sq.—and passing through it there was a current at 11,000 volts. Sheriff Thomson commented on the frequency of such accidents, and imposed a fine of £20.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

PANAMA.—The following goods are admitted free of duty:—Irrigation machinery for farms and plantations; articles imported by municipal corporations for the improvement of towns; machinery imported by the Isthmian Canal Commission; machinery, supplies, &c., imported by the Panama Railway Co. Other goods not specially mentioned in the tariff pay a duty of 10 per cent. *ad valorem*.

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

12,447. "Improvements in or relating to means or apparatus for holding electric arc or other lamps in position, and also releasing them when required." J. JACKSON. May 23rd.

12,469. "Improvements relating to magneto cut-outs for motor cycles." M. D. MOTT. May 23rd.

12,483. "Improvements in or relating to electric arc lamps." SIEMENS-SCHUCKERT WERKE G.M.B.H. (Date applied for under Sec. 91 of the Act, May 24th, 1909, being date of application in Germany.) May 23rd. (Complete.)

12,489. "Improvements relating to electric switches." H. E. DEY. (Date applied for under Rule 13, October 21st, 1909. An invention comprised in Application No. 24,408, dated October 21st, 1909.) May 23rd. (Complete.)

12,490. "Improvements relating to electric switches." H. E. DEY. (Date applied for under Rule 13, October 21st, 1909. An invention comprised in Application No. 24,208, dated October 21st, 1909.) May 23rd. (Complete.)

12,497. "Improvements in the electro-deposition of zinc." S. O. COWPER-COLES. May 23rd.

12,522. "Improvements relating to electric switches." H. R. SCHULTZ. (Date applied for under Rule 13, July 24th, 1909. An invention comprised in Application No. 17,273, dated July 24th, 1909.) May 23rd. (Complete.)

12,524. "Improvements in and relating to magneto-electric machines for velocipede lamps and like purposes." C. SCHLICK. (Application for Patent of Addition to No. 5,043, 1910.) May 23rd. (Complete.)

12,576. "Improvements in and relating to electric signalling and like systems." A. E. VICKERY. May 24th.

12,593. "Device for leading current to an ignition device for combustion engines." SOCIETE INDUSTRIELLE DE DELLE. (Date applied for under Sec. 91 of the Act, June 3rd, 1909, being date of application in France.) May 24th. Complete.)

12,594. "Improvements in or relating to dynamo-electric machines." O. I. BLATHY. (Date applied for under Sec. 91 of the Act, May 27th, 1909, being date of application in Hungary.) May 24th. (Complete.)

12,601. "Improvements in electrical resistance furnaces." O. SERPEK. May 24th. (Complete.)

12,606. "Improvements relating to coin-freed gas, liquid or electric meters." C. P. CHISHOLM and A. B. TENNEY. May 24th. (Complete.)

12,609. "Improvements in electric lampholders." S. B. FRIBERG. May 24th.

12,614. "Improvements in and relating to automatic telephone systems." AMERICAN AUTOMATIC TELEPHONE CO. and C. L. GOODRUM. May 24th. (Complete.)

12,616. "Improved means applicable for use in detecting electrical oscillations." J. G. BALSILLIE and BRITISH RADIO-TELEGRAPH AND TELEPHONE CO., LTD. May 24th.

12,625. "Improvements in negative plates for storage batteries and in processes for the manufacture thereof." P. G. SALOM. May 24th. (Complete.)

12,627. "Improvements in methods of utilising radiant energy." R. A. FESSENDEN. (Application for Patent of Addition to No. 28,677 of 1909.) May 24th.

12,683. "Universal electric rotary indicator." W. G. LAWSON and G. B. DENT. May 24th.

12,701. "Improvements relating to electric change over switches." A. H. ADAMS and ADAMS MANUFACTURING CO., LTD. May 25th.

12,703. "Arrangements for building up twin projectors from existing single projectors." SIEMENS BROS. & CO., LTD., F. HIRD and J. H. BRADLEY. (Application for Patent of Addition to No. 27,914 of 1909.) May 24th.

12,708. "Improvements in time-limit or retarding devices for use in connection with electric circuit-breakers." ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., and N. COLLINS. May 25th. (Complete.)

12,709. "Improvements in and relating to the electrical operation of gun mechanism and the like." H. C. LEAKE. (Date applied for under Rule 13, June 18th, 1909. An invention comprised in Application No. 14,890 dated June 18th, 1909.) May 25th.

12,721. "Improvements in methods of and apparatus for electric welding and repairing." H. L. J. SIEMUND. (Date applied for under Sec. 91 of the Act, June 3rd, 1909, being date of application in United States.) May 25th. (Complete.)

12,739. "Auxiliary telephone receiver." W. SCHWARZHAUPT. May 25th. (Complete.)

12,746. "Spherical gonimeter for measuring angles of gyration relatively to the horizon and magnetic meridian in aerial and submarine navigation." C. B. B. LAURES. (Date applied for under Sec. 91 of the Act, June 21st, 1909, being date of application in France.) May 25th. (Complete.)

12,754. "Improvements in or relating to machines for making incandescent electric lamps." W. L. PAKENHAM and "Z" ELECTRIC LAMP MANUFACTURING CO., LTD. May 25th.

12,757. "Improvements in alloys useful as electric resistance conductors." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) May 25th. (Complete.)

12,758. "Improvements in composite wires." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) May 25th.

12,783. "Improvements in portable electric lamps." J. DUNCAN. May 26th.

12,787. "Improvements in or connected with armatures for dynamo-electric motors and generators." J. MARCHANT and J. H. MARCHANT. May 26th.

12,791. "Improved mode of controlling electric lights and in apparatus therefor." R. J. AIKEN. May 26th.

12,814. "Combined interrupter and switch for use either with magneto or accumulator ignition for motors." J. MILLER. May 26th.

12,815. "Arrangements for localising faults on high-tension alternating-current systems." A. M. TAYLOR. May 26th.

12,820. "Improvements in sparking plugs for internal combustion engines." B. BROOKS and F. H. ALSTON. May 26th. (Complete.)

12,836. "Improved sparking plug." L. LAMPLOUGH. May 26th.

12,862. "Improvements in trolley stands for electrically-propelled vehicles." E. L. FIXLER and W. BURGESS. May 26th. (Complete.)

12,865. "New method of and means for the application of electricity to measure the depth of water." J. L. MASON. May 27th.

12,868. "Improvements in electric ignition apparatus." R. F. HALL. May 27th.

12,889. "Improvements in the method of cooling the commutators and slip-rings of dynamo-electric machines." BRUSH ELECTRICAL ENGINEERING CO., LTD., and A. W. JONES. May 27th.

12,903. "Improvements in electric conduit fittings and the accessories for same." C. E. GUNNER. (Date applied for under Rule 13, November 29th, 1909. An invention comprised in Application No. 12,563, dated May 27th, 1909.) May 27th. (Complete.)

12,926. "Improvements in or relating to alternating electric current distributing systems." G. BERRY. May 27th.

12,936. "Improvements in electric heating apparatus." H. VAN DER WEYDE. May 27th.

12,966. "Improvements in or relating to the attachment of shades and the like to electric light globe sockets." F. T. JACKSON and T. REYNOLDS. May 28th.

13,015. "Improvements in movable coil alternating-current transformers for supplying currents of constant values." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens-Schuckertwerke G.m.b.H., Germany.) (Complete.)

13,020. "Improvements in the electric lighting of tramcars and other vehicles." JOHNSON & PHILLIPS, LTD., and W. F. GRAFTON. May 28th.

13,021. "Improvements in high-frequency alternating-current generators." JOHNSON & PHILLIPS, LTD., and W. F. GRAFTON. May 28th.

13,035. "Improvements in or relating to electric lighting of vehicles." E. GABREAU. May 28th. (Complete.)

13,036. "Improvements in bulbs for incandescent electric lamps." E. S. ARRIGHI. May 28th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

METAL-FILAMENT ELECTRIC LAMPS. Felten & Guilleaume Lahmeyer Werke Akt.-Ges. 17,960. August 3rd. (Date applied for under International Convention, January 2nd, 1909.)

PROCESSES AND APPARATUS FOR THE ELECTROLYTIC PRODUCTION OF SALT SOLUTIONS. T. Girtin. 20,192. September 3rd. (Cognate application, No. 28,119 of 1909.)

METAL-FILAMENT INCANDESCENT ELECTRIC LAMPS. H. Zschocke. 21,285. September 17th.

INSTALLATIONS OF ELECTRICALLY-PROPELLED VEHICLES FOR THE PURPOSE OF OBTAINING CURRENT FOR BRAKING. G. Rizzo. 21,669. September 22nd. (Date applied for under Rule 13, March 22nd, 1909.)

TROLLEY CLIPS FOR ELECTRIC CONDUCTORS. R. Michaelson. 22,904. October 7th.

ELECTRIC LIGHT FIXTURES. M. Rush. 24,599. October 26th.

CLOCKWORK MECHANISM PROVIDED WITH AN ELECTRIC WINDING DEVICE. J. Steiger and J. Besancon. 27,154. November 22nd.

DETECTION OF THERMAL OR ELECTRICAL ENERGY. Amalgamated Radio Telegraph Co. (O. von Bronk.) 27,289. November 27th.

ELECTRICAL STORAGE BATTERY. A. W. Somers and R. J. Crowley. 5,062. March 2nd.

TESTING OF ELECTRICITY METERS. M. Kallmann. 7,764. March 31st. (Date applied for under International Convention, July 18th, 1908.)

ELECTRIC CONDUCTORS. R. K. Gray. 7,791. April 1st.

ELECTRIC LOCKS. Greenhill and Goddard. 10,345. May 1st.

PROCESS FOR THE ELECTRO-DEPOSITION OF IRON. S. O. Cowper-Coles. 10,655. May 5th.

ELECTROLYTE FOR PRIMARY OR SECONDARY GALVANIC BATTERIES, APPLICABLE ALSO AS AN ELECTROLYTICAL RESISTANCE FOR ELECTRIC CURRENTS OF ANY ORDER. G. Schauli. 10,791. May 6th.

MAGNETIC COMPASSES FOR PREVENTING THE ERRORS OF STEERING, AND FOR INDICATING THE COURSE TO BE STEERED. L. Nicholas. 10,925. May 8th.

CONTROL OF ELECTRIC MOTORS. A. J. Dawson and R. P. Pyne. 11,445. May 14th.

ELECTRIC STAFF OR TABLET SYSTEM OF CONTROLLING RAILWAY TRAFFIC. Blackall and Jacobs. 11,460. May 14th.

DEVICE FOR AUTOMATICALLY CONNECTING-UP THE SUBSCRIBERS OF A TELEPHONE EXCHANGE. Peticky, F. Suchanek and I. Cizek. 11,497. May 14th. Application for Patent of Addition to No. 28,036 of 1904.)

APPARATUS FOR ELECTRO-THERAPEUTIC TREATMENT. N. Tscherkassoff. 13,542. June 5th.

ELECTRIC ARC LAMPS. Jaburg. 15,981. July 7th. (Date applied for under International Convention, July 1st, 1908. (Originally included in No. 7,471 of 1909.)

ELECTRIC TRANSMISSION FOR MOTOR VEHICLES. W. Morrison. 16,331. July 13th.

HANGERS AND THE LIKE FOR ELECTRICAL CONDUCTORS. E. M. Munro and Railless Electric Traction Co. 17,326. July 20th.

PHOTOGRAPHICALLY-RECORDING TYPE-PRINTING TELEGRAPH. D. Murray. 22,457. October 2nd.

ELECTRIC CONDUIT JOINTS AND JOINT-BOXES. W. R. Sykes and V. J. Cooke. 26,02.. November 10th.

ELECTROMAGNETIC COUPLINGS. J. Verney. 26,574. November 16th. (Date applied for under International Convention, November 16th, 1908.)

WIRELESS TELEGRAPHIC SIGNALLING APPARATUS. G. Erdmann. 28,545. December 7th. (Request under Sec. 19 not granted.)

ARC LAMP CASINGS. R. Binet and G. Guenne. 28,849. December 9th. (Date applied for under International Convention, December 11th, 1908.)

POLARISED RELAYS FOR SELECTIVE ELECTRIC SIGNALLING. W. J. Thorrowgood. 30,579. December 31st.